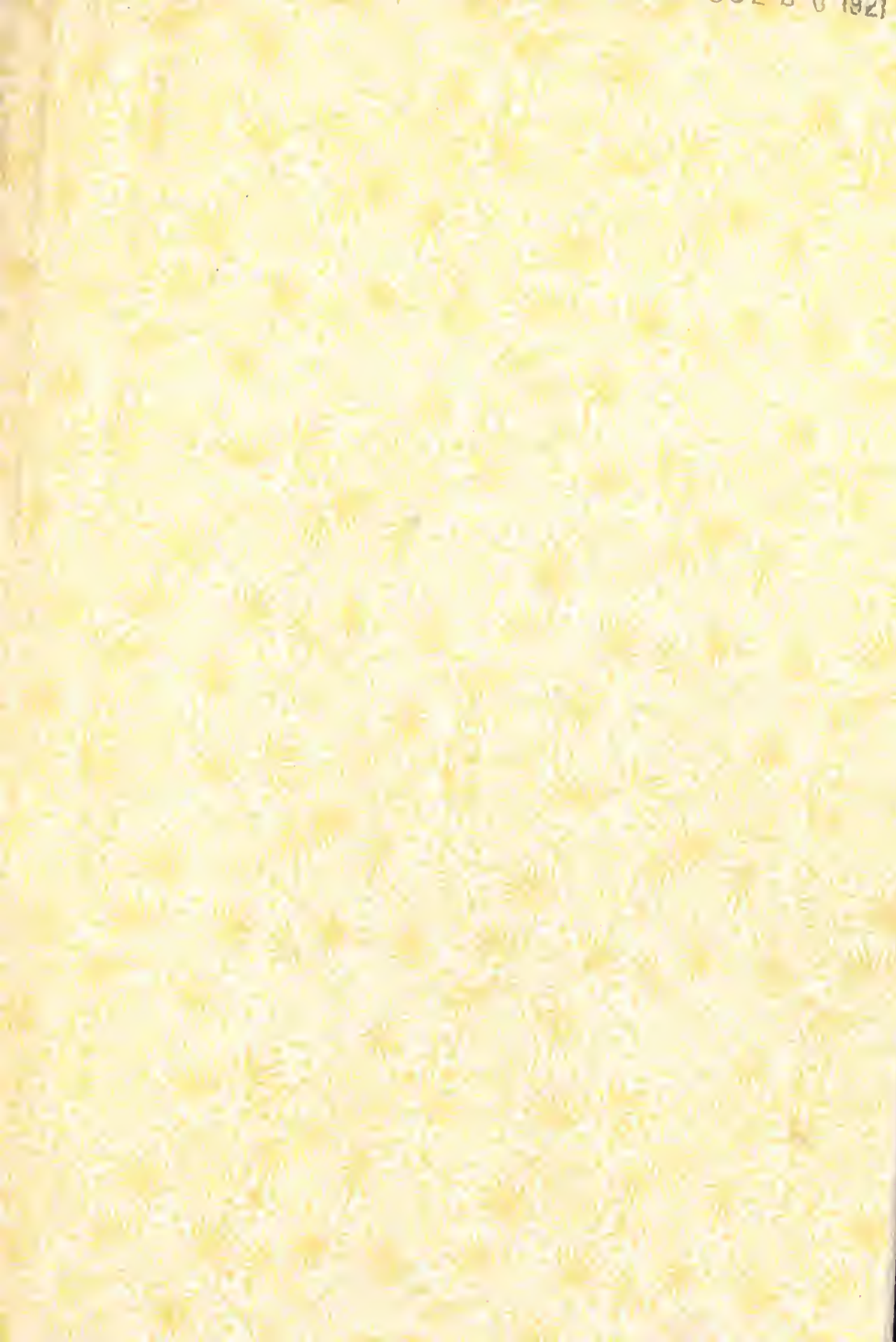



• THE BROOKLYN INSTITUTE OF ARTS & SCIENCES •





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BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES VII

BROOKLYN, N. Y., APRIL 2, 1919

No. 1

MAKING A LAWN

In lawn making, as in all branches of gardening, the preparation of the soil is a primary consideration. The lawn presumably is intended to be a permanent feature, and when one is convinced that a little extra care at the outset will save a great deal of trouble and disappointment later on, the desirability of thorough preparation is at once apparent.

There should be at least six or eight inches of good top soil. If it is deeper than this, so much the better. The result will be evident during dry spells in the shape of fresh green grass when lawns which have an insufficient depth of top soil will be brown and dreary looking. It is important that the soil be of uniform depth and fertility. If it is not, the lawn will present a patchy appearance, especially in periods of drought, owing to moisture and nutriment being unequally distributed.

When grading is necessary, strip the top soil from the part to be cut or filled before the grade is corrected. When correcting the grade, make allowance for the top soil that is to be replaced and also for the subsidence of the disturbed subsoil.

Kentucky blue, the best lawn grass, succeeds best on limestone soils. If there is a deficiency of lime, with a resultant sourness in the soil, an application of 15 pounds of ground limestone, or half this quantity of air-slaked lime, to 300 square feet, will be an advantage. The desirability or otherwise of liming may be determined by pressing blue litmus paper on a handful of the moist soil; if the litmus turns red it indicates an acid condition and the need of lime.

The fertilizer should be spread over the surface before the operation of spading or plowing is commenced. The best fertilizer is well decayed barnyard or stable manure applied about three inches thick all over the plot. This will provide the necessary humus in addition to the fertilizing elements it contains. If barnyard manure is unavailable, one of the numerous brands of prepared humus may be used in smaller quantities. When the

ground is already covered with a growth of sod, the necessity of applying humus is not so urgent, as the decay of the grass roots and tops will supply any lack. In such cases the addition of commercial fertilizer in the proportion of 5% nitrogen, 8% phosphorus, and 10% potash, at the rate of 12 to 18 pounds to 400 square feet, will suffice.

The fertilizer having been evenly distributed over the plot, the next process is spading up the top soil or plowing in the case of large areas. Never attempt any work on the soil when it is so wet as to be sticky. When spading, the soil should be dug up to a depth of a foot, if the good earth extends that far, at the same time thoroughly mixing in the fertilizer. All clods should be broken up and large stones thrown out. If the ground is covered with grass, the sods should be buried grass side downward. The surface should now be raked with an iron-toothed rake until a finely pulverized seed bed is formed. Usually the tramping the plot receives in the process of fining the surface is sufficient to pack the ground to the required degree of firmness, as shown by footmarks being barely discernible when the plot is walked upon. If the ground is not compacted sufficiently, it will be necessary to consolidate it by more tramping or by rolling with a light roller. The surface must be loosened to a depth of half an inch or so with a rake, before the seed is sown.

When the plot is of such a size that plowing is possible, the work of pulverizing the soil after plowing, preparatory to seed sowing, can with advantage be done by using a harrow. It will be necessary, however, to use a rake for the finishing touches as in the case of ground prepared by spading.

A calm day should be chosen for sowing the seed or there will be great difficulty in distributing it evenly. Do the work systematically. Divide the seed into two equal portions. Take one of these, and, starting at one end of the plot, walk back and forth scattering the seed as evenly as possible. Keep the hand low and do not attempt to cover too wide an area at a time. The other half of the seed should be distributed by walking over the plot at right angles to the route travelled in sowing the first portion. This ensures an even distribution of the seed. If a large plot is to be sown, it is a good plan to mark off the area into several equal-sized plots. Divide the seed to correspond, and sow each plot separately. This is very helpful in apportioning the seed evenly all over the area.

When the seed has been sown, the surface should be lightly raked to cover the seed, and then rolled. If a roller is not available, a tamper is a fair substitute for firming the soil about the seeds. A suitable tamper can readily be improvised by sawing about eighteen inches from a plank two or three inches thick and a foot wide. A hole should be bored in the center of this, and a

handle of suitable length inserted. A stout broom handle or an old shovel or spade handle can be used for this purpose.

It is not economical to sow grass seed sparingly. When the grass seeds are sown thinly a splendid opportunity is offered to the weed seeds, of which they do not fail to take advantage. This necessitates much back-breaking work to get the lawn clear of weeds and may require even the breaking up of the lawn and a fresh start. On the other hand, a generous sowing of seed ensures a good stand of grass which will choke out many of the obnoxious weeds. The quantity to use is one quart of seed to 300 square feet.

Kentucky blue grass (*Poa pratensis*) is considered to be the best grass for lawns in this section, and should form the basis of all grass seed mixtures. Red top (*Agrostis alba*) and Rhode Island bent (*Agrostis canina*) are used, associated with Kentucky blue, to cover the ground until the latter gets a good start, when it may be expected to crowd them out. A good proportion to use is two parts, by weight, of Kentucky blue grass to one each of red top and Rhode Island bent.

The use of white clover (*Trifolium repens*) as an ingredient in lawn mixtures is largely a matter to be decided by the personal taste of the lawn maker. It is considered to be a good practice to use clover when making a lawn on sandy soils. It is deep rooting, withstands drought well, and protects the young grasses until they become established. On soils that are suitable to lawns, clover is usually crowded out in two or three years by the grass. If it is desired to use clover, the seed should be sown at the same time as the grass, but as a separate operation. Clover seed is heavy and is liable to sink to the bottom of the package if mixed with grass seed before sowing. This results in an uneven distribution of clover and a patchy lawn. Use one ounce of seed, or a little over, to 300 square feet.

For shady places where the ordinary grass mixtures will not thrive, those kinds which will stand shade conditions should be planted. The wood meadow grass (*Poa nemoralis*) is one of the best of these, but appears to be a scarce article at present. Kentucky blue grass, Rhode Island bent, and Canadian blue grass (*Poa compressa*) are also good.

When only a small lawn is to be seeded, it is probably the best plan to purchase a grass mixture from a reliable seedsman, rather than to buy the separate ingredients. Most seedsmen have mixtures ready prepared for ordinary soil, for shade, for sandy soil, for tennis courts, and so on. Avoid low-priced grass seeds, for they are not cheap. There is great variation in the grades of grass seed. Red top varies in weight from 10 to 45 pounds to the bushel; Kentucky blue, from 10 to 22 pounds, the difference being caused by the presence or absence of chaff and foreign matter. It is easy

to see that a low-priced mixture, with a large percentage of chaff, is not a good purchase.

A lawn may be seeded down either in the spring or fall. If made in the spring, the work should be done as soon as possible after the soil is in a friable condition. From the latter part of March until the middle of May conditions are usually suitable. When the lawn is made in the fall, weather conditions largely determine the time of seeding. The seed may be sown at any time from the latter part of August until the beginning of October, but not during a period of drought unless there are ample facilities for watering artificially.

As soon as the grass is between two and three inches high it should be mown. The lawn mower should be sharp and the blades set as high as possible. If the ground is soft or sandy it is a good plan to roll the grass lightly a day or two before mowing. This will compact the soil around the grass roots and prevent the grass from being pulled up when the mower is used.

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Telephone: 6173 Prospect.

Mail address: Brooklyn Botanic Garden, Brooklyn, N. Y.

BROOKLYN BOTANIC GARDEN

LEAFLETS

SERIES VII

BROOKLYN, N. Y., APRIL 16, 1919

No. 2

THE SIXTH ANNUAL GARDEN EXHIBIT FOR BROOKLYN BOYS AND GIRLS

Time—The sixth annual Garden Exhibit for the boys and girls of Brooklyn will be held on September 20 and 21. Note that September 21 falls on a Sunday. We planned this. Why? So your fathers could come. Isn't that good? The exhibit will be open on these exhibit days from 10 a. m. until 4 p. m.

Place—Our exhibit will be held in the central rotunda of the laboratory building, at the Botanic Garden. The building may be entered, either from Washington Avenue, No. 978, or from the Garden side.

Conditions of Entry—Be sure that each separate exhibit, unless it be a part of the class or school exhibit, has an entry card with the exhibitor's name, school, and address upon it. These entry cards may be had from us in early September, and should be filled in exactly as indicated. Bring the exhibits to the Botanic Garden on September 19th, between 9 a. m. and 5 p. m.

Time of Judging—Three expert judges will judge these exhibits and make public their decisions on September 20, at 10 a. m.

Prizes—1. *Individual*. These prizes are, as heretofore, silver medals as first, and bronze medals as second prizes.

2. *Groups*. Prizes in *Classes A, B and C* are won by groups of boys and girls working together. The **FIRST PRIZE in Class A** is a trophy won by P. S. 98 for the last two years. If P. S. 98 wins this in the 1919 exhibit it will be theirs to retain always. The **SECOND PRIZE** is a silver cup. **FIRST and SECOND PRIZES in Class B** will be silver cups, which remain, when won, as the permanent property of the school or association. *Class C* has, as a **FIRST PRIZE**, a bronze statue of Victory. One school, winning this statue three times, is entitled to it. The **SECOND PRIZE** will be a silver cup.

Removal of Exhibits—Exhibits may be taken away by the exhibitors at 4 p. m. on September 21, or at any time before the 25th.

Presentation of Prizes—Prizes, both individual and group, will be presented on October 11, at 3 p. m., in the auditorium of the

Brooklyn Botanic Garden building. No prize winner will receive his prize unless he presents himself or sends a substitute on October 11.

To be Noted—Read over instructions concerning *Class K*. To enter this contest, apply at once by letter or otherwise or before July 1 to the Curator of Elementary Instruction, at the Brooklyn Botanic Garden. An enrollment card will be sent to you. These prize gardens will be visited during the summer. For the prizes in this class and the conditions for entry read under instructions of *Class K*.

To be Specially Noted—The Alfred T. White Scholarship. What is it? A college scholarship of \$100 for the boy or girl working at least two seasons at the Brooklyn Botanic Garden and showing marked ability in High School biology. When will it be given? For the first time in 1920 and annually thereafter. How can I become a candidate for the Alfred T. White Scholarship? By applying at once to the Brooklyn Botanic Garden and then keeping busy with your hoe, and your biology books, and by your efforts toward being an all-around good young citizen of the Borough of Brooklyn.

Class A—School Display. FIRST PRIZE, a trophy to the school making the best display, to be held for a year only, or until won three times, when it becomes the permanent property of the winning school. SECOND PRIZE, a silver cup. Last year P. S. 98 won first place in *Class A* for the second time. Remember, three times winning gives P. S. 98 the trophy. This year we want some new schools to try for this. See if this year your school cannot send in the best collection of vegetables, flowers and plants. These may be raised either at schools or in home gardens.

Class B—Community Garden Display. *Class B* differs from *Class A* in several respects. In the first place, *Class A* must be the work of a school, either supervised or non-supervised work. It usually is the latter. *Class B*, the Community Garden Display, is represented by those schools having instruction throughout the summer—for example, school gardens under the supervision of the Board of Education, gardens under the supervision of the Park Department, or community gardens under the supervision of a paid instructor. The FIRST PRIZE in this exhibit is a silver cup; the SECOND PRIZE a silver cup.

Class C—Box Display. This display will consist of plants and flowers in boxes, and of potted plants. There are schools where it is impossible to have a school garden, and where the neighborhood is such that it is impossible to have home gardens; for such this class is added. The FIRST PRIZE in this exhibit is a bronze statue of Victory which shall be competed for under the same conditions as those for the trophy in *Class A*. SECOND PRIZE is a silver cup.

Class D—Flowers. This is a class for individual competition, and in which first and second prizes are offered. In this and the

following classes the **FIRST PRIZES** are silver medals; **SECOND PRIZES**, bronze medals. Certificates of honorable mention will also be awarded. If a boy or girl enters an individual class, he must understand that these same products cannot count toward his school display. Double entries should be made in such cases. Do not forget this. If you enter zinnias for an individual prize and wish to add zinnias to the school display, then you must bring two bunches of zinnias. The divisions in *Class D* are as follows:

- | | |
|---|--|
| No. 1. Ageratum
Best 4 sprays | No. 11. Marigold
(Giant African)
Best collection of 12 |
| No. 2. Alyssum
Best plant (potted) | No. 12. Marigold
(Dwarf French)
Best collection of 12 |
| No. 3. Asters, blue
Best collection of 10 | No. 13. Marigold
Best plant (potted) |
| No. 4. Asters, pink
Best collection of 10 | No. 14. Nasturtium
Best collection of 12 |
| No. 5. Asters, white
Best collection of 10 | No. 15. Phlox
Best collection of 8 |
| No. 6. Asters, mixed
Best collection of 12 | No. 16. Sunflower
Largest flower |
| No. 7. Asters
Best plant (potted) | No. 17. Verbena
Best collection of 10 |
| No. 8. Calendula
Best collection of 8 | No. 18. Zinnia
Best collection of 10 |
| No. 9. Cornflower
Best collection of 12 | |
| No. 10. Dianthus
Best collection of 10 | |

Class E—Vegetables. Surely this ought to be a popular class this year. Plan ahead so your vegetables will be in their prime at exhibit time. Try to send in perfect specimens. If, for example, you are exhibiting under No. 17, red tomatoes, have your eight tomatoes as near the same size as possible. Wash your vegetables carefully, so that they make an attractive appearance. **FIRST PRIZES** in this class are silver medals; **SECOND PRIZES**, bronze medals; **THIRD PRIZES**, certificates of honorable mention.

DIVISIONS IN CLASS E

- | | |
|---|--|
| No. 1. Beans, bush
Best pint, shelled | No. 10. Onions
Best 4 |
| No. 2. Beans
Best quart, unshelled | No. 11. Peppers
Best 4 |
| No. 3. Beets
Best bunch of 6 | No. 12. Potatoes
Best 6 |
| No. 4. Carrots
Best bunch of 5 | No. 13. Pumpkin
Best specimen |
| No. 5. Cabbage
Best head | No. 14. Radishes
Best 8 |
| No. 6. Corn
Best 6 ears | No. 15. Squash
Best specimen |
| No. 7. Egg-plant
Best 2 | No. 16. Tomatoes, green
Best 8 |
| No. 8. Kohlrabi
Best 4 | No. 17. Tomatoes, red
Best 8 |
| No. 9. Lettuce
Best 2 heads
(roots and all) | No. 18. Tomatoes
Small-fruited varieties
Best 10 |

Class F—Best Special Plant. Any plant cared for by the exhibitor may be entered. The plant may be a geranium raised from a cutting, an aster from seed, a fern from a runner—it matters not so long as the work is yours. The plant stands no chance of prize winning if it is not in good condition, clean, properly potted, and free from insect pests. **FIRST PRIZE**, a silver medal; **SECOND PRIZE**, a bronze medal; **THIRD PRIZE**, a certificate of honorable mention.

Class G—Best Bunch of Flowers. Judged on perfection of the flowers and taste in arrangement. **FIRST PRIZE** in this class is a silver medal; **SECOND PRIZE**, a bronze medal; **THIRD PRIZE**, a certificate of honorable mention.

Class H—Individual Garden Display. The greatest variety of flowers or vegetables raised by one child constitutes this display. Here is an opportunity to show some originality and taste in the way you put together and arrange your own exhibit. Let us have more exhibits in this class this year. **FIRST PRIZE**, a silver prize; **SECOND PRIZE**, a bronze medal; **THIRD PRIZE**, a certificate of honorable mention.

Class I—Weed Display. This weed exhibit may be one of either fresh or pressed specimens. No exhibit can take a prize unless the specimens are carefully and correctly named. If you go away to the country in the summer you will have a good opportunity to make a large collection of weeds and wild flowers for the exhibit. **FIRST PRIZE** is a silver medal; **SECOND PRIZE**, a bronze medal; and certificates of honorable mention will be awarded to those taking third places.

Class J—Wild Flowers. Similar to *Class I*. **FIRST PRIZE**, a silver medal; **SECOND PRIZE**, a bronze medal; **THIRD PRIZE**, certificates of honorable mention.

Class K (a)—Back Yard Gardens. Boys: \$15.00 IN WAR SAVINGS STAMPS will be present-d to the boy having the best back yard garden in Brooklyn. \$10.00 IN WAR SAVINGS STAMPS will be given to the boy having the second best back yard garden. Conditions for these prizes are as follows: First, the garden must be kept by the applicant; second, the garden must be at least 10x20; third, plans, diagram, costs of seed, amount of crop must be all submitted in writing to the Botanic Garden at the time of the exhibit. These gardens must be entered in this contest by July 1st, and will be visited at least twice during the season by a judge from the Botanic Garden.

Class K (b)—Same for girls as Class K (a).

ELLEN EDDY SHAW,
Curator of Elementary Instruction.

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES VII

BROOKLYN, N. Y., APRIL 30, 1919

No. 3

THE ROCK GARDEN

The Rock Garden of the Brooklyn Botanic Garden was constructed in the spring of 1916. The rocks are, for the most part, glacial boulders which were uncovered in the course of grading operations on other parts of the grounds. These boulders were very unprepossessing material for the construction of a rock garden, their rounded contours almost prohibiting any natural and artistic effects from being obtained. Their hard, impervious surfaces are far from ideal from the standpoint of the cultural requirement of the alpine plants, which revel in rocks of a loose, porous nature to which their roots may cling. In spite of these disadvantages, one is cheered by overhearing visitors commenting on the "wildness" and natural appearance of the garden. The fact that over six hundred species and varieties are now growing in the garden, many of them alpine considered very intractable in this part of the country, is testimony that the difficulties of cultivation have, in part, been overcome. In order to provide quarters for plants that delight in rock crevices, a number of the larger boulders were split and the fissures filled with suitable soil. That all of these crevices are not occupied with happily thriving plants is partly due to the taking propensities of some of our visitors, who remove the plants almost as fast as they are set out.

What is known in garden parlance as a "moraine garden" was constructed in 1917 to care for some of the more capricious alpine. It was made by excavating the soil over a small area of the rock garden to a depth of eighteen inches or two feet, and replacing it with a mixture of three-quarter inch crushed stone, five parts; sand, one part; and leaf mould, one part. This provides perfect drainage, and encourages the roots to penetrate deeply where it is cool and moist, a most important point in the cultivation of alpine. It also ensures perfect ripening of the top

growth, enabling the plants to better withstand the vagaries of our winters. Among the subjects planted in the moraine are *Androsace*, *Saxifraga*, *Primula*, and *Asperula*. Their growth has been encouraging and there is a prospect that we may have to extend our "moraine garden."

The general idea in constructing the garden was that of a boulder strewn slope. This design, of necessity, was modified in places to provide proper cultural conditions as to drainage, depth of soil, and shade. The desirability of walks or trails, so that visitors might get near enough to the plants (some of which are very diminutive) to appreciate their beauty, was another factor which inhibited the idea of a boulder strewn slope being carried out in its entirety. The provision of adequate facilities in the way of paths in a rock garden which is open to the public is always a problem when a naturalistic effect is desired. If the walks and trails are constructed of rocks similar in character to those used in the body of the garden, and made without definite boundaries so as to merge into the garden, many plants are doomed to destruction by the feet of visitors, particularly small and active boys, who wander from the straight and narrow way. The problem was partly overcome in the Royal Gardens, Kew, England, by constructing the rock garden in the simulation of the bed and banks of a dried-up Pyrenean mountain stream. The bed of the stream is represented by a wide gravel path. Even with this arrangement, some of the plants on the higher parts of the garden cannot be readily seen from the walk, and it is no uncommon sight to see visitors armed with field glasses studying the plants and labels on the higher levels. Is it too much to hope that some day the people of Brooklyn may become imbued with such a love for plants that, instead of walking over, injuring, and sometimes destroying the plants that lie between them and the object of their interest, they will have recourse to field glasses? Bird lovers habitually use them. Why should not their use be extended to the flower lover?

As it was decided that the accessibility of the plants to the public was of greater importance than maintaining intact the ideal of a stony slope, our garden is well provided with walks and trails. These are made of irregular flag stones, laid informally, and, in the case of the small trails, with a stepping stone effect. There is very little excuse for deserting the walks for the purpose of inspecting the plants—that is, unless one is so unfortunate as to be very near-sighted.

The rock garden is intended primarily to supply proper cultural conditions and to display in a suitable setting, alpine and saxatile plants, and may thus be considered as an ecological exhibit. With

this in mind, the garden was located opposite, and adjacent to the Ecological Section, in point of fact being a part of and tying up with the latter feature. The desirability of making the rock garden an adjunct to the Ecological Section resulted in a south eastern exposure which is not considered ideal from the gardening standpoint, because of the lack of shade for the plants that object to full sunshine. This disadvantage has been overcome by saving a few small trees that happened to be on the site and by disposing many of the larger boulders so that they cast some shade.

Rock gardens undoubtedly were brought into existence mainly for the benefit of alpine; rock plants, not necessarily alpine, being included later. In actual practice, most rock gardens are not limited to these two groups. At the present time, in many well known gardens, any hardy plants of a dwarf nature are considered as suitable planting material. Reginald Farrar, the well known English authority on rock gardens, in his definition of plants suitable for a rock garden . . . "includes everything that will look well in a rock garden". Under this ruling many plants, not alpine, not saxatile, and whose cultivation presents no difficulties under the conditions obtaining in the perennial border or shrubbery must be admitted. Owing to the difficulty of quickly assembling a large collection of alpine and rock plants, and the necessity of planting some quick growing material to hide the glaring hideousness of some of the boulders, Mr. Farrar's definition of what constitutes a rock garden plant has been temporarily accepted by the Botanic Garden. The ideal in mind, however, is to strictly limit the planting to material that really "belongs". With this end in view, our stock of alpine and rock plants is constantly being increased by propagation from seeds and cuttings, and by exchange and purchase. Unfortunately the actual planting cannot go on as fast as could be desired. Many of our rare plants have been stolen almost immediately after being set out (apparently we have a connoisseur of alpine plants in our midst), and in some cases our entire stock of some rare plants has been lost in this way. This has indicated the necessity of waiting until a considerable quantity of these rare plants can be propagated before planting any of them in the garden, so that a reserve supply may be held in a more secluded spot to guard against accidents.

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THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES VII

BROOKLYN, N. Y., MAY 7, 1919

No. 4

FLOWERS OF THE ROCK GARDEN

In the month of May the rock garden is at its best. It is at this time that the majority of alpiners and rock plants are in bloom, and their beauty of form and gaiety of coloring make a picture that never fails to satisfy the eye. It must not be inferred that the rock garden is lacking in interest at other seasons of the year: from late winter right up to leaf-fall there is always something in bloom, and, even when not flowering, many of these alpiners are of value for their beautiful or curious foliage. At the time of writing (March 15th), in spite of the ground being covered with a slight fall of snow, several mountain species of *Crocus* are bravely displaying their blossoms. These are not the corpulent kinds so greatly in favor for spring bedding, but are dainty wildlings, full of charm and elegance. *Bulbocodium vernum*, the spring meadow-saffron, from the mountains of Europe and Russian Asia, is also in bloom. The color of the flowers, rosy purple, is not all that could be desired, but one cannot afford to be hypercritical of colors in the outdoor garden at this season of the year. *Erica carnea*, a native of the Alps, and one of the best of the hardy heaths, is also in bloom, and will remain in good condition until May. *Saxifraga Burseriana*, a native of the mountains of Central Europe, is displaying its pure white flowers in the "moraine." This is one of the gems of the genus and well worth the extra care necessary to make it happy. *Iris reticulata*, a bulbous iris from Asia Minor and Persia, is getting ready to display its bright purple flowers, which have a delightful violet-like perfume. Other plants that are showing their flower buds are the grape hyacinths, *Muscari* species, and several species of *Primula*. Among the latter are *P. denticulata*, from the Himalayas, which has pale purple flowers arranged in a dense head on the top of a long scape; *P. frondosa*; *P. farinosa*; and *P. marginata*.

During the month of April the most conspicuous objects in the rock garden are several large groups of golden tuft, *Alyssum*

saxatile. It is of easy cultivation and succeeds in almost any kind of soil, but it must be exposed to sunshine. The columbines begin to bloom this month. *Aquilegia canadensis*, our common columbine, grows wild in rocky places over a large portion of the country east of the Rocky Mountains. There is a large group of the Rocky Mountain columbine, *Aquilegia caerulea*, by the side of the upper walk. It is difficult to get the true plants of this species with characteristic blue and white flowers, and ours show considerable color variation, probably due to hybridization with other species. The double-flowered form of *Arabis albida* blooms this month and remains in good condition a long time. This species is frequently sold under the name of *A. alpina*, a similar species but not so showy as *A. albida*. *A. aubrietoides*, a species with bright pink flowers, also blooms about this time. It is rather cranky and not so amenable to cultivation as the other kinds. Other plants that may be expected to bloom in April are the mountain spurge, *Pachysandra procumbens*, and several forms of *Aubrietia deltoidea*.

In the early part of May, *Veronica repens*, a diminutive speedwell, is covered with pale blue blossoms that almost completely hide the creeping stems. An interesting little willow herb, *Epilobium nummulariaefolium*, hailing from the mountains of New Zealand, shows its charming foliage to good effect about this time. This is an excellent carpeting plant, clinging close and completely hiding the ground. It has made itself thoroughly at home, and self-sown seedlings have sprung up all over the rockery. Indeed, there is a possibility that it may become something of a nuisance and necessitate rigorous repression.

Toward the middle of May great activity prevails and many plants come into bloom, some of which are mentioned below. *Gypsophila cerastioides*, a very dwarf baby's breath from the Himalayas, has large white flowers veined with pink. This occupies a position on the left at the entrance of the northernmost walk. We have two forms of *Gypsophila repens*, which grows wild in the Alps and Pyrenees. One of these, the larger kind, is reminiscent of the common baby's breath of our borders. *Achillea ageratifolia*, from the hills of Greece, and *A. serbica*, from rocky Serbia, maintain their flowers in good condition well into June. These are milfoils with large white flowers, and silvery foliage that is attractive throughout the larger part of the year. *Mazus reptans*, a creeping figwort from the Himalayas, is sometimes killed off during hard winters, but comes up smiling in the spring from self-sown seeds. It has pale purple flowers, of which a few are always in evidence from May until frost. *Androsace sarmentosa*, and allied Himalayan rock jasmines, with pink flowers in umbels, may be found blooming in the "moraine." *Erinus alpinus*, which blooms from April to June, grows in small patches in several

places throughout the rockery. A form known to horticulturists as *E. alpinus carmineus* has flowers of a clearer, brighter color than the purplish *E. alpinus*. The green cushions of some of the mossy saxifrages are spangled with white or red blooms, according to variety. Most of our *Saxifrages* are growing in the low part of the garden at the extreme south. Here may be seen *S. irrigua*, *S. caespitosa*, *S. "Mayflower,"* *S. punctata*, *S. Hostii*, and several others. *Silene alpestris*, the alpine catchfly; *Hutchinsia alpina*; *Myosotis alpestris*, the alpine Forget-me-not; and *Cerastium Thomasii* are other May flowering rock plants.

In June we have the dwarf, large-flowered alpine asters, *Aster alpinus*, and its forms, of which there are several good clumps. The various bellflowers begin to bloom in June and carry on into July. *Campanula carpatica*, the Carpathian harebell, and several garden forms are very striking. *C. arvensis*; *C. rotundifolia*, the blue bells of Scotland; and *C. Portenschlagiana* (an ugly name for a beautiful plant), are of interest. Many species and varieties of the hardy pinks, some of them mountain and rock plants, and some of them more plebeian in origin, perfume the air with their fragrance. One of the gems of the collection is *Dianthus glacialis* var. *neglectus*, the glacier pink. *Gentiana cruciata* is the only example of the large gentian family that is thriving vigorously. This has a rather dishevelled appearance and flowers of a dirty blue. *G. acaulis*, whose blooms are of the true gentian blue, has not yet taken very kindly to our conditions. Other June flowering rock plants are the rock roses, *Helianthemum* species and varieties; golden drop, *Onosma echinoides*; and *Saponaria ocymoides*, a member of the carnation family, which produces showers of pink blossoms.

In July many of the *Sempervivums* are in bloom. The most striking of these is the cobweb houseleek, *Sempervivum arachnoideum*. This has flowers of dull red arising from rosettes of fleshy leaves, the tips of which are connected with gossamer-like threads. We have from fifteen to twenty species of *Sedum*, quite a number of which may be expected to bloom this month. Their flowers, as a rule, are not particularly showy. *S. caeruleum* is noteworthy in that it is an annual and has blue flowers. *Linaria alpina*, a charming little toadflax, is in bloom during July and August. The flowers are blue and orange in color, and there is a form in which pink is substituted for the blue.

Among the many other interesting plants that might be mentioned are the following: the edelweiss, *Leontopodium alpinum*, which, contrary to the general opinion, is of easy cultivation; the lady's mantle, *Alchemilla alpina*, with insignificant flowers but exquisitely beautiful foliage; the rock spray, *Cotoneaster horizontalis*, a shrub the branches of which closely follow the contours

of the rocks; the mountain cranberry, *Vaccinium Vitis-Idaea*, a dwarf evergreen with shining leaves, widely distributed in arctic regions. *Corydalis lutea*, a yellow-flowered fumitory with glaucous leaves, is quite at home in the crevices at the side of the steps at the south end of the garden. It grows wild in stony places in Europe and in many sections has naturalized itself on old walls. *Calandrinia umbellata*, a member of the purslane family from Peru, displays its showy, crimson-magenta flowers from June until frost.

MONTAGUE FREE.

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LEAFLETS

KEY TO SOME OF THE PRINCIPAL FAMILIES OF FLOWERING PLANTS

- I. DICOTYLEDONS, with 2 seed-leaves (100,000 species). Flowers generally in 5s or 4s; leaves netted-veined; fibro-vascular bundles arranged in a circle.
 1. Petals none (Apetalous); with or without calyx. Mostly wind pollinated.
 2. Flowers in scaly spikes, or catkins. Trees or shrubs.
 3. The two sexes on different plants (dioecious)—**Salicaceae** (Willow, Poplar).
 3. The two sexes on the same plant (monoecious).
 4. Leaves pinnately compound (**Juglandaceae**) (Walnut, Hickory).
 4. Leaves simple.
 5. Pistillate flowers in catkins—**Betulaceae** (Birch, Alder, Hazel, Hornbeam).
 5. Pistillate flower form nuts, enclosed in bracts (cupules)—**Fagaceae** (Beech, Chestnut, Oak).
 5. Pistillate flowers form fleshy fruit—**Moraceae** (Mulberry, Osage Orange, Fig, Breadfruit).
 2. Flowers not in catkins. Calyx sometimes petal-like.
 3. Shrubs or trees—Elm, Hackberry, Maple (sometimes with petals); Sycamore, Sassafras, Camphor, Cinnamon, Leatherwood.
 3. Herbs.
 4. Pistil 1.
 5. Stipules sheathing the stem at swollen joints—**Polygonaceae**. (Buckwheat, Rhubarb, Smartweed, Dock).
 5. Weedy herbs. Flowers small, greenish—**Chenopodiaceae** (Lamb's quarters, Beet, Chard, Spinach).
 5. Weedy herbs. Flowers scarious—**Amaranthaceae** (Pigweed, or Amaranth family).
 5. Calyx tubular or funnel-form, and colored like a corolla—**Nyctaginaceae** (Four-o'clock family).
 5. With milky juice and reduced flowers—**Euphorbiaceae** (Spurge family) (Castor bean, Hevea—Brazilian rubber tree, Poinsettia, Crown-of-Thorns).
 4. Pistils generally more than 1. Stamens numerous, on the receptacle. Petals sometimes present—**Ranunculaceae** (Crowfoot family) (Anemone, Marsh Marigold).

1. Petals present, not united (Polypetalous).
2. Ovary superior.
 3. Stamens generally more than 10.
 4. Stamens on receptacle.
 5. Aquatic herbs, with shield-shaped leaves (stamens on ovary in water-lily)—**Nymphaeaceae** (Water-lily family).
 5. Leaves generally dissected, in 3s—**Ranunculaceae** (Crow-foot family) (Buttercup, Larkspur, Columbine).
 5. Trees, with large flowers and conical fruit—**Magnoliaceae** (Magnolia, Tulip tree).
 5. Herbs with milky or colored narcotic juice—**Papaveraceae** (Poppy, Bloodroot, Celandine).
 5. Stamens monadelphous (united in a tube, anthers 1-celled)—**Malvaceae** (Mallow family) (Cotton, Okra).
 5. Leaves pellucid punctate with glandular dots—**Hypericaceae** (St. John's-wort family).
 4. Stamens on calyx.
 5. Leaves opposite or alternate, usually without stipules—**Saxifragaceae** (Saxifrage, Gooseberry, Currant).
 5. Leaves alternate, with stipules—**Rosaceae** (Rose, Spiraea, Strawberry, Blackberry, Raspberry, Plum, Peach).
3. Stamens not more than 10.
 4. Fruit a legume, like the pea-pod. Corolla generally papilionaceous, like the sweet pea—**Leguminosae** (Legume family) (Pea, Bean, Alfalfa, Clover, Lentil, Soybean, Liquorice).
 4. Stamens 4 long and 2 short (tetradynamous). Flowers cruciform—**Cruciferae** (Mustard family) (Cabbage, Cauliflower, Radish, Turnip, Rape).
 4. Mature carpels 5, each 1-seeded, breaking away from the elongated axis—**Geraniaceae** (Geranium family).
 4. Trees or shrubs. Leaves punctate with glandular dots, pistils raised on a glandular disk—**Rutaceae** (Prickly ash, Orange, Lemon, Citron, Lime, Grapefruit).
 4. Trees or shrubs, with resinous or milky, sometimes poisonous, juice; small 5-parted flowers; ovary 1-celled and 1-ovuled, forming mostly a drupe—**Anacardiaceae** (Sumach family) (Poison Ivy, Smoke-tree, Sumach).
 4. Shrubs, usually climbing by tendrils. Berry 2-celled, usually 4 seeded—**Vitaceae** (Grape, Woodbine).
 4. Herbs, with a 1-spurred corolla. Fruit 3-carpelled, 1-celled, with 3 parietal placentae—**Violaceae** (Violet, Pansy).
2. Ovary inferior.
 3. Some **Rosaceae** (**Pomeae**, or Apple family) (Apple, Pear, Quince, Loquat, Hawthorne, Juneberry, Mountain ash).
 3. Fleshy, mostly leafless plants—**Cactaceae** (Cactus family).
 3. Flowers mostly 4-parted. Ovary 2-4 celled—**Onagraceae** (Evening Primrose family).
 3. Fruit berry-like; flowers in umbels—**Araliaceae** (Ginseng, Spikenard, Hercules' Club).
 3. Fruit dry, ribbed. Flowers in umbels—**Umbelliferae** (Parsley family) (Carrot, Parsnip, Parsley, Celery, Caraway, Anise, Sweet Cicely).
 3. Shrubs or trees, with leaves having prominently sunken veins. Fruit a 1-2 seeded drupe—**Cornaceae** (Dogwood).

1. Petals united (Sympetalous, or Gamopetalous).
2. Ovary superior.
 3. Corolla regular.
 4. Ovary 3-10 celled; anthers opening by terminal chinks or pores. Mostly shrubs—**Ericaceae** (Heath, Indian Pipe, Rhododendron, Trailing Arbutus, Cranberry, Blueberry, Huckleberry).
 4. Ovary 1-celled, with free-central placenta. Stamens opposite the petal-lobes, inserted on the tube—**Primulaceae** (Primrose, Shooting Star).
 4. Ovary 2-celled, with 2 (rarely more) ovules in each. Trees or shrubs, with 4-parted flowers—**Oleaceae** (Olive family) (Ash, Lilac, Privet).
 4. Ovary 1-celled, with 2 parietal placentae; many seeds. Leaves opposite and sessile—**Gentianaceae** (Gentian family).
 4. Ovaries 2, with a common stigma. Juice milky.
 5. Stamens not united—**Apocynaceae** (Dogbane, Myrtle).
 5. Stamens united; pollen in masses—**Asclepiadaceae** (Milkweed family).
 4. Ovary 2-(or 3-) celled, with 2 ovules in each. Flowers mostly large and showy. Chiefly twining herbs, often with milky juice—**Convolvulaceae** (Morning Glory family) (Sweet Potato, Bindweed, Dodder).
 4. Ovary 3-celled, few—many seeded. Not twining—**Polemoniaceae** (Phlox family).
 4. Ovary 1-celled, with 2 parietal placentae; 4-many seeds—**Hydrophyllaceae** (Waterleaf family).
 4. Ovary deeply 4-lobed—**Boraginaceae** (Borage family) (Heliotrope, Bluebells).
 4. Ovary 2-celled, many seeded. Fruit generally a berry—**Solanaceae** (Nightshade family) (Potato, Tomato, Tobacco, Egg-plant, Ground Cherry.)
 3. Corolla irregular, 2-lipped. Stamens 2 long, 2 short (didynamous), sometimes 2.
 4. Ovary 2-4-celled, not lobed—**Verbenaceae** (Verbena family).
 4. Ovary deeply 4-lobed; stems square; leaves aromatic—**Labiatae** (Mint family).
 4. Ovary 2-celled, many seeded; with axile placentae—**Scrophulariaceae** (Figwort family) (Snapdragon, Veronica, Foxglove).
 4. Ovary 2-celled, many seeded; with parietal placentae. Woody plants—**Bignoniaceae** (Trumpet flower, Catalpa).
 4. Ovary 2-celled; 4-12-seeded. Chiefly herbs, with opposite leaves—**Acanthaceae** (Acanthus family).
2. Ovary inferior.
 3. Tendril bearing herbs. Anthers commonly united—**Cucurbitaceae** (Gourd, Muskmelon, Watermelon, Pumpkin).
 3. Without tendrils.
 4. Corolla regular. Leaves opposite or whorled, with stipules—**Rubiaceae** (Madder family) (Galium, Bluets, Coffee, Cinchona).
 4. Leaves opposite or perfoliate, without stipules. Mostly shrubs—**Caprifoliaceae** (Honeysuckle family) (Viburnum, Elder).
 4. Flowers in heads; stamens distinct—**Dipsacaceae** (Teasel family).

4. Corolla regular and bell-shaped. Herbs with milky juice—**Campanulaceae** (Bluebell family).
4. Stamens with united anthers (syngenesious).
 5. Flowers irregular, not in heads—**Lobeliaceae** (Lobelia family).
 5. Flowers in heads, with strap-shaped or tubular corolla, calyx a pappus; fruit an achene—**Compositae** (Composite family) (Golden-rod, Aster, Sunflower, Arnica, Dandelion, Endive, Chicory, Salsify, Lettuce).

II. MONOCOTYLEDONS, with 1 seed-leaf (25,000 species. Flowers generally in 3s; leaves mostly parallel-veined; fibro-vascular bundles scattered.

1. Carpels 1 or more, distinct. Perianth wanting, or inconspicuous; scale or bristle-like (except in **Alismaceae** and **Palms**).
2. Aquatic or marsh plants. Flowers in dense spikes.
 3. Minute floating aquatics—**Lemnaceae** (Duckweed family).
 3. Flowers in dense terminal spikes—**Typhaceae** (Cat-tail family).
 3. Marsh or immersed aquatic herbs—**Naiadaceae** (Pondweed family) (Potamogeton).
 3. With 3 conspicuous petals and 3 sepals, and numerous pistils—**Alismaceae** (Water-Plantain family) (Sagittaria).
2. Flowers on a true spadix (fleshy spike), with or without an enveloping spathe—**Araceae** (Arum, Indian Turnip, Calla Lily, Calamus, Skunk Cabbage, Golden Club, Anthurium).
2. Flowers on a usually branched axis, enclosed in a sheath (spathe). Tropical or subtropical trees—**Palmae** (Palm family) (Cocanut, Date, Ivory-nut).
2. Flowers enclosed in dry, chaffy scales (glumes). Grass-like plants with jointed stems.
 3. Stems round or flattened and usually hollow; leaf-sheaths split; anthers attached at middle—**Gramineae** (Grass family) (Wheat, Corn, Rye, Barley, Sugar Cane, Rice, Bamboo).
 3. Stems triangular and solid; leaf-sheaths not split; anthers attached at base—**Cyperaceae** (Sedge family).
1. Carpels usually 3, united to form a compound pistil. Perianth usually conspicuous.
 2. Ovary superior. Corolla regular.
 3. Grass-like, or rush-like plants—**Juncaceae** (Rush family).
 3. Not grass-like. Sepals and petals colored alike (except in **Trillium**)—**Liliaceae** (Lily family) (Asparagus, Onion, Leek, Hyacinth, Lily-of-the-valley, Smilax, Century Plant).
 2. Ovary inferior.
 3. Corolla regular or nearly so.
 4. Stamens 6—**Amaryllidaceae** (Amaryllis, Narcissus, Agave, Star-grass).
 4. Stamens 6; mostly epiphytic tropical or subtropical plants—**Bromeliaceae** (Pineapple, Spanish Moss).
 4. Stamens 3—**Iridaceae** (Iris, Crocus, Gladiolus).
 3. Corolla irregular.
 4. Stamens 5—**Musaceae** (Banana, Manila Hemp).
 4. Stamens mostly petal-like, only $\frac{1}{2}$ of one fertile—**Cannaceae** (Canna family).
 4. Stamens 1. Aromatic plants—**Zingiberaceae** (Ginger, Cardamom).
 4. Stamens 1 (or 2 in Ladies' Slipper)—**Orchidaceae** (Orchid family) (Vanilla).

LEAFLETS

SERIES VII

BROOKLYN, N. Y., JUNE 4, 1919

No. 6

THE SINGLE-PERIOD COLD-PACK CANNING OF FRUITS AND VEGETABLES.*

Because of the increased interest in the conservation of foods, so greatly developed in the last five years, much care has been taken to find the simplest and most satisfactory method of canning fruits and vegetables. To most who have tried the various ways there is no method so easy and satisfactory as the "single-period cold-pack" process. "Cold-pack" refers to the manner of putting the food, uncooked, into the jars, and cooking afterwards. "Single-period" refers to the manner of cooking the jars of food for one continuous period of time, instead of cooking them for a shorter time on two or three successive days. (The latter method, known as "intermittent sterilization", though somewhat in use, is obviously less convenient than the "single-period sterilization".)

The necessary equipment for single-period cold-pack canning is as follows:

1. A large kettle, pail or wash-boiler, several inches deeper than the jars to be filled, and a cover for the same.
2. A rack of wire or slats fitted to the boiler, to keep the jars one-half to three-fourths inch above the bottom.
3. A colander and a second kettle large enough to hold it.
4. One or two large squares of cheesecloth.
5. Paring knife, vegetable brush, long-handled fork, slender wooden spoon, measuring spoon, measuring cup, and a hooked wire or other device for lifting the hot jars.
6. Fruit jars of any of the common makes, Lightning, or Mason, or similar styles, having glass tops, being preferred by most.

*Acknowledgement is made to the U. S. Department of Agriculture for the table here given and for other help, derived chiefly from the Federal Bulletins.

Preliminary steps (to be done the day before if desired).

1. Wash the jars in hot soapy water and rinse thoroughly.
2. Test jars for leakage by filling with water, sealing with *new* rubber rings and sound tops. Turn each upside down and watch for oozing at the seal. Do not waste valuable time and materials by trying to can with cracked, nicked jars and old rubbers. However, do not discard every jar that leaks when first tested. One top may fit a jar when another will not. Wire guards may be tightened or loosened by bending. The bent edge of a Mason screw top may be gently hammered into shape. Preparing the jars for canning is tedious to many, but essential for good work.

3. Prepare sugar syrup according to the sweetness desired. The following table is well approved.

Thin syrup: 1 part of sugar to 3 parts of water, for sweet fruits.

Medium syrup: 1 part of sugar to 2 parts of water, for sour fruits.

Thick syrup: 1 part of sugar to 1 part of water, for very sour fruit or for richer preserves.

Heat the water to boiling; add the sugar gradually, stirring constantly until sugar is dissolved. Continue boiling for three minutes more. Skim if necessary.

Preparing the food for packing.

1. Select only sound, fresh fruit or vegetables, which are not over-ripe. Vegetables are best canned within six hours of gathering, but satisfactory results have been gained when the vegetables had been plucked for as long as twenty-four hours, when they had been kept cool. Corn, peas and lima beans are particularly difficult if not used when very fresh. Wash the vegetables well, scrubbing rough-skinned ones with a brush. Delicate fruits like berries should be washed a few at a time in a colander by letting cold or lukewarm water run through them.

2. Blanch as follows: Put the food to be blanched into a cheesecloth or colander, and dip into boiling water. Cover, and keep water boiling for the time indicated in the table. Remove from the boiling water, and plunge into the coldest water available for a moment only. Many prefer to blanch greens in the steam over the boiling water, and so lose less of the very soluble but highly valuable mineral and other food materials. (See also *Footnote 1.*)

3. After blanching, drain, and remove skins. Most will slip off easily, though a few like carrots will require scraping.

Packing.—Put the food to be canned, either whole or in pieces, into the clean jars, packing closely but without mashing, filling jar to the top. Corn, peas and lima beans are best packed to within an inch of the top to allow for swelling. Fill vegetable jars to overflowing with hot water, adding one teaspoonful of salt

for each jar. (With tomatoes it is preferable to fill the can with tomato sauce made of the irregular pieces cooked up, than to fill the jars with water.) Fill fruit jars to overflowing with syrup. Now put on the freshly washed rubber rings, and the covers. Partially seal, *i. e.*, put the upper guard only of a Lightning or similar jar in place, and with a Mason screw top or the like, screw down gently—with the thumb and little finger is a good way to keep it from being too tight.

Processing.—Place the jars on a rack in *warm* water in the boiler, having the water at least one inch above the tops of the jars. (See *Footnote 2.*) Bring to the boiling point and then time their boiling according to the table given. An alarm clock set to remind one when the sterilizing time is up is a great help. If the sterilizing period is a long one, boiling water will have to be added to the boiler at times to keep the water-bath at the right depth. At end of "processing" time remove jars from the boiler, seal completely, and turn upside down on a table well padded with paper or cloths, and away from drafts. Cover with a towel while cooling.

Inspection and Storage.—Watch for leakage or for rising of air bubbles, while jars are still inverted, from a break in the rubber, which would indicate imperfect seal. In such a case the top or rubber probably would be at fault, and a second sterilization would be required on the following day, of 20 to 30 minutes duration (40-50 min. for peas, beans or corn), after liquid has been added to replace any loss, and the jar sealed and fitted with a new top and rubber. This emergency is extremely rare if jars are tested at the first as they should be.

If no leakage is occurring, wash and label the jars, and put away in a dark, cool place. If a really dark place is not available, place the jars in paper bags or wrap separately in paper.

N. M. HOWELLS.

Footnote 1. Blanching is done for the following purposes:

1. To more thoroughly cleanse the surface than by merely washing.
2. To set the color.
3. To render the skins more easily removed.
4. To make the flavor more delicate, especially with vegetables.
5. To shrink the food so that more can be packed in the can.

Blanching should not involve a great loss of juice. Beets, for instance, should have root and one inch of stem left on during blanching.

Footnote 2. It may be feared by some that when jars are only partially sealed, but completely submerged in water, the flavor of one food will pass to a jar of another. This has not been found to be so, however—even when onions are canned at the same time with other vegetables, with spinach, for instance.

TIME-TABLE FOR BLANCHING AND STERILIZING

The following time-table shows blanching time for various vegetables and fruits, and also sterilizing time in the hot-water bath outfit, and in equipment for sterilization by the steam-pressure method:

Vegetables	Blanching	Sterilizing		
		Hot water	Steam pressure, lbs.	
		Minutes	5 to 10	10 to 15
	Minutes	Minutes	Minutes	Minutes
Asparagus	10-15	120	60	40
Beets	5	90	60	40
Brussels sprouts	5-10	120	60	40
Cabbage... ..	5-10	120	60	40
Cauliflower	3	60	30	20
Carrots	5	90	60	40
Corn	5-10	180	90	60
Greens.....	15	120	60	40
Lima Beans	5-10	180	60	40
Okra	5-10	120	60	40
Parsnips ...	5	90	60	40
Peppers, sweet or hot	5-10	120	60	40
Peppers, pimentos ...	Roast	35	20	15
Peas	5-10	180	60	40
Pumpkin... ..	To a mush	120	60	40
Salsify ...	5	90	60	40
Sour-kraut	120	60	40
String beans	5-10	120	60	40
Squash (Winter).....	To a mush	120	60	40
Squash (Summer)... ..	10	120	60	40
Tomatoes	To loosen skins	22	15	10
Fruits				
Apples.....	1½	20	8	...
Apricots...	1-2	16	10	...
Blackberries	none	16	10	...
Blueberries	none	16	10	...
Dewberries	none	16	10	...
Cherries, sweet	none	16	10	...
Cherries, sour	none	16	10	...
Currants ...	none	16	10	...
Fruit juices	none	20-30	8-12	...
Gooseberries	1-2	16	10	...
Oranges ...	1-2	12	6	...
Pears	1½	20	8	...
Peaches ...	To loosen skins	16	10	...
Plums ...	none	16	10	...
Pineapples	3-5	30	10	...
Quinces ...	1½	20	8	...
Raspberries	none	16	10	...
Rhubarb (Blanch before paring)	1-2	20	15	...
Strawberries	none	16	10	...
Fruits without sugar..	30	12	...

The time given in this table is for quart jars. Add 30 minutes for 2-quart jars and deduct 5 minutes for pint jars.

The time given is for fresh, sound and firm vegetables. Increase the time of sterilization by adding one-fifth for vegetables which have been gathered over 24 hours.

The time given is for altitudes up to 1000 feet above sea level. For higher altitudes increase the time in hot-water bath 10 per cent for each additional 500 feet. For example, if the time is given as 120 minutes in the table and your location is 1500 feet above sea level, the time should be made 132 minutes.

Neither home-made nor commercial hot-water bath outfits are entirely satisfactory, however, for canning at very high altitudes, as the temperature of water in them does not reach 212 degrees F. In such localities water-seal and steam-pressure outfits are advisable, as they give higher temperatures.

LEAFLETS

TREES OF PROSPECT PARK AND
BROOKLYN BOTANIC GARDEN

This list is intended to include the trees of Prospect Park and additional hardy genera in the Botanic Garden. Nearly a hundred genera of trees may be grown in the region of New York. This includes a few such as witchhazel and sumach, which are usually tall shrubs; also some such as *Sequoia* and *Hovenia* of uncertain hardiness. Trees growing wild in the New York region are unmarked; those from the Southern States are marked *s*; from the Western States *w*; from Europe *e*; from Asia *a*. The main groups are as follows:

Seeds naked: families 1-4.

Seeds enclosed: angiosperms—

Flowers inconspicuous, mostly wind pollinated, families 5-11.

Petals separate (polypetalous), families 12-35.

Petals united (sympetalous), families 36-42.

The characters given after family names may not apply to species other than those mentioned.

1—GINKGO FAMILY. Leaves fan-shaped, seed fleshy.

a Maidenhair Tree (*Ginkgo biloba*).

2—YEW FAMILY. Seed in red fleshy disk.

e English Yew (*Taxus baccata*).

3—PINE FAMILY. Leaves needle-shaped, seeds in cones.

Spruce (*Picea*): White (*canadensis*); Black (*mariana*); Red (*rubra*); *w* Colorado Blue (*hungensis*); *w* Engelmann (*Engelmanni*); *e* Norway (*excelsa*).

Hemlock (*Tsuga*): Northern (*canadensis*); *s* Carolina (*caroliniana*).

w Douglas Spruce (*Pseudotsuga taxifolia*).

Fir (*Abies*): Balsam (*balsamea*); *w* White (*concolor*); *e* European (*alba*); *w* (*firma*).

Larch or Tamarack (*Larix*): American (*laricina*); *e* European (*decidua*).

a Golden Larch (*Pseudolarix kaempferi*).

African Cedar (*Cedrus atlantica*), Africa.

Pine (*Pinus*): White (*Strobus*); Red (*resinosa*); Pitch (*rigida*); Jersey (*virginiana*); Yellow (*echinata*); *e* Scotch (*sylvestris*); Loblolly (*Taeda*); *e* Swiss Stone (*Cembra*); *e* Austria (*nigra*); *a* Bhotan (*excelsa*).

a Umbrella Pine (*Sciadopitys verticillata*).

w California Big Tree (*Sequoia gigantea*).

a Cryptomeria (*C. japonica*).

s Bald Cypress (*Taxodium distichum*).

4—CYPRESS FAMILY. Leaves scale-like, opposite.

Arbor Vitae (*Thuja*): American (*occidentalis*); *a* Oriental (*orientalis*).

a Thujopsis (*T. dolabrata*).

w Western White Cedar (*Libocedrus decurrens*).

White Cedar (*Chamaecyparis thyoides*); *w* Yellow Cedar (*C. nootkatensis*); *a* Sawara Cypress (*C. pisifera*).

Red Cedar (*Juniperus virginiana*).

5—WILLOW FAMILY. Stamens and pistils on separate trees (dioecious).

Willow (*Salix*): Black (*nigra*); Peach-leaved (*amygdaloides*); Shining (*lucida*); Sandbar (*tongifolia*); Balsam (*balsamifera*); Glauous (*discolor*); *e* White (*alba*); *e* Yellow (*vitellina*); *a* Weeping (*babylonica*).

Poplar (*Populus*): Trembling Aspen (*tremuloides*); Largetoothed P. (*grandidentata*); Downy (*heterophylla*); Balsam (*balsamifera*); *a* Balm of Gilead (*candicans*); Cottonwood (*deltoides*); Carolina P. (*Eugenei* Hort.); *e* Lombardy (*nigra italica*); *e* Silver (*alba*); *a* Bolle's (*alba Bolleana*).

6—WALNUT FAMILY. Leaves compound, flowers monoecious.

Walnut (*Juglans*): Butternut or White W. (*cinerea*); *e* English (*regia*); Black (*nigra*).

Hickory (*Carya*): Shagbark (*ovata*); King nut (*laciniosa*) Mockernut (*alba*); Pignut (*glabra*); Bitter nut (*cordiformis*).

a Caucasian Walnut (*Pterocarya fraxinifolia*).

7—BIRCH FAMILY. Monoecious, both kinds of flowers in catkins.

Birch (*Betula*): Gray (*populifolia*); White (*alba*); Black (*lenta*); Yellow (*lutea*); Red (*nigra*).

Alder (*Alnus*): *e* European (*glutinosa*).

Hornbeam or Blue Beech (*Carpinus*): American (*caroliniana*); *e* European (*Betulus*).

Ironwood or Hop Hornbeam (*Ostrya virginiana*).

8—OAK FAMILY. Monoecious, staminate flowers only in catkins.

Beech (*Fagus*): American (*grandifolia*) *e* European (*sylvatica*), (Purple var. and cut-leaved var.)

Chestnut (*Castanea dentata*); Chinquapin (*C. pumila*).

Oak (*Quercus*): White (*alba*); Swamp White (*bicolor*); Post (*stellata*); Overcup (*lyrata*); Bur (*macrocarpa*); Chestnut O. (*Prinus*); Willow O. (*Phellos*); Red (*rubra*); Black (*velutina*); Scarlet (*coccinea*); Pin (*palustris*); Black Jack (*marilandica*); *s* Laurel Oak (*imbricaria*); *e* English (*Robur*); *e* Turkey (*Cerris*).

9—ELM FAMILY. Inconspicuous flowers with sepals and petals.

Elm (*Ulmus*): American or White *americana*; (Slippery or Red (*fulva*); Cork or Rock (*racemosa*); *e* English (*campestris*) *e* Scotch or Wych (*glabra*); *e* Camperdown (*glabra Camperdownii*).

Hackberry (*Celtis occidentalis*).

a Zelkova (*Z. serrata* and *utmoides*).

10—MULBERRY FAMILY. Monoecious; sap milky.

Mulberry (*Morus*): Red (*rubra*); *a* White (*alba*).

a Paper Mulberry (*Broussonetia papyrifera*).

w Osage Orange (*Maclura pomifera*).

11—KATSURA TREE FAMILY. No sepals or petals.

a Tetracentron (*T. sinense*).

a Euptelea (*E. polyandra*).

a Katsura Tree (*Cercidiphyllum japonicum*).

12—MAGNOLIA FAMILY. Flowers large, all parts separate.

Magnolia (*Magnolia*): *s* Umbrella Tree (*tripetala*); *s* Cucumber Tree (*acuminata*); Fraser Magnolia (*Fraseri*); *s* Great-Leaved M. (*macrophylla*); Sweet Bay (*glauc*); *a* Soulange's M. (*Soulangeana*).

Tulip Tree (*Liriodendron tulipifera*).

13—CUSTARD APPLE FAMILY. Small tree, 3 sepals, 3 petals, large fruit.

s Papaw (*Asimina triloba*).

14—LAUREL FAMILY. Leaves aromatic, three forms, fruit blue.

Sassafras (*S. variifolium*).

15.—WITCHHAZEL FAMILY. Capsule two-celled, two-beaked.
Sweet Gum (*Liquidambar styraciflua*).
Witchhazel (*Hamamelis virginiana*).
a Parrotia (*P. persica*).

16—CHINESE RUBBER TREE FAMILY. No sepals or petals, fruit winged, one-seeded.
a Chinese Rubber Tree (*Eucommia ulmoides*).

17—PLANE TREE FAMILY. Leaf base surrounds bud; flowers in spherical head.
Plane Tree (*Platanus*): American (*occidentalis*); *e* European (*acerifolia*).

18—APPLE FAMILY. Ovary inferior, fruit apple-like.
e Apple (*Malus pumila*); *a* Flowering Crab (*M. floribunda*).
e Pear (*Pyrus communis*).
Mountain Ash (*Sorbus*): American (*americana*); *e* European (*Aucuparia*).
a Quince (*Cydonia oblonga*).
Shadbush (*Amelanchier canadensis*).
Hawthorn (*Crataegus*): Cockspur (*Crusgalli*); *e* English Hawthorn (*Oxyacantha*); Scarlet Haw (*mollis*).

19—PLUM FAMILY. Ovary superior, stone-fruit.
Cherry (*Pruuus*); Black (*serotina*); Choke (*virginiana*); Pin or Bird (*penusylvanica*); *a* Sweet (*Avium*); *a* Japanese Flowering C. (*serulata* and *Launesiana*); *a* Sour (*Cerasus*); Wild Plum (*mericana*); *e* Cultivated Plum (*domestica*) *a* Peach (*Persica*).

20—PEA FAMILY. Flower pea-like, fruit a legume, leaves usually compound.
Redbud (*Cercis canadensis*).
s Kentucky Coffee Tree (*Gymnocladus dioica*).
Honey Locust (*Gleditsia Triacanthos*).
s Yellow-wood or Virgilia (*Cladrastis lutea*).
a Maackia (*M. amurensis*).
Locust (*Robinia Pseudacacia*); Clammy Locust (*viscosa*).
a Pagoda Tree (*Sophora japonica*).

21—RUE FAMILY. Leaves compound with pellucid glands, ovary on disk.
Hop Tree or Wafer Ash (*Ptelea trifoliata*).
Prickly Ash (*Zanthoxylum americanum*).
a Evodia (*E. Danielii*).
a Cork Tree (*Phellodendron amurense*).

22—AILANTHUS FAMILY. Leaves compound with glands, ovary on disk.
a Tree of Heaven (*Ailanthus glandulosa*).

23—MAHOGANY TREE. Leaves compound, ovary on disk, stamens united.
a Cedrela (*C. sinensis*).

24—SUMACH FAMILY. Usually shrubs; leaves compound.
Sumach (*Rhus*); Smooth (*glabra*); Velvet or Staghorn (*typhina*) Dwarf (*copallina*); Poison (*Vernix*); *a* Varnish Tree (*verniciiflua*).
s American Smoke Tree (*Cotinus americanus*).

25—HOLLY FAMILY. Flowers small, axillary.
Holly (*Ilex*): American (*opaca*); *e* European (*Aquilifolium*); Mountain (*monticola*).

26—MAPLE FAMILY. Leaves opposite, usually palmately lobed, fruit winged.
Maple (*Acer*): Silver (*saccharinum*); Red (*rubrum*); Sugar (*saccharum*); Boxelder (*Negundo*); Striped (*penusylvanicum*); *e* Norway (*platanoides*); *e* Sycamore M. (*pseudoplatanus*); *e* English Field M. (*campestre*); *a* Japanese (*palmatum* and *japonicum*).

27—HORSECHESTNUT FAMILY. Leaves opposite, palmately compound.

Horsechestnut (*Aesculus Hippocastanum*); *w* Ohio Buckeye (*A. glabra*);
w Sweet Buckeye (*A. octandra*).

28—SOAPBERRY FAMILY. Leaves pinnately compound.

a Soapberry (*Sapindus Drummondii*).

a Koelreuteria (*K. paniculata*).

29.—BUCKTHORN FAMILY.—Flowers small, greenish; fruit stem edible.

a Japanese Raisin Tree (*Hovenia dulcis*).

30—LINDEN FAMILY. Stamens in groups, united at base.

Linden (*Tilia*): American L. or Basswood (*americana*); White (*heterophylla*); *e* European (*vulgaris*); *e* European Silver (*tomentosa*);
e Large-leaved L. (*platyphyllos*).

31—INDIA PLUM FAMILY. Leaves with long petioles.

a Idesia (*I. polycarpa*).

a Poliothyraxis (*P. sinensis*).

32—OLEASTER FAMILY. Leaves with silvery and brown scales.

e Sea Buckthorn (*Hippophae rhamnoides*).

e Oleaster (*Elaeagnus angustifolia*).

33—TUPELO FAMILY. Ovary inferior; fruit a drupe.

Tupelo or Sour Gum (*Nyssa sylvatica*); *s* Large Tupelo (*N. aquatica*).

a Davidia (*D. involucrata*).

34—GINSENG FAMILY. Small prickly trees, fruit a berry.

Hercules' Club (*Aralia spinosa*).

a Acanthopanax (*A. ricinifolius*).

35—DOGWOOD FAMILY. Leaves opposite, flowers small, petals 4.

Dogwood (*Cornus*); Flowering (*florida*); Alternate Leaf (*alternifolia*);

e Cornelian Cherry (*Mas*); *a* Japanese D. (*Kousa*).

36—HEATH FAMILY. Flowers bell-shaped, stamens separate.

s Lily-of-the-Valley Tree or Sorrel Tree (*Oxydendrum arborescens*).

37—EBONY FAMILY. Leaves with entire margin, fruit plum-like.

s Persimmon (*Diospyros virginiana*).

38—STORAX FAMILY. Small trees, fruit one-seeded.

s Silverbell (*Halesia carolina*).

a Pterostyrax (*P. hispida*).

a Storax (*Styrax japonica*).

39—ASH FAMILY. Leaves opposite, floral parts in fours or twos.

Ash (*Fraxinus*): American (*americana*); Red (*pennsylvanica*); Green

(*laucolata*); Black (*nigra*); *w* Blue (*quadriangulata*); *e* European

(*excelsior*); *e* European Single-leaved A. (*excelsior monophylla*);

e Flowering (*Ornus*).

Fringe Tree (*Chionanthus virginica*).

a Tree Lilac (*Syringa japonica*).

40—FIGWORT FAMILY. Flowers showy, fruit a two-celled capsule.

a Empress Tree (*Paulownia tomentosa*).

41—CATALPA FAMILY. Fruit long two-celled capsule, seeds winged.

Catalpa: *s* Eastern (*C. bignonioides*); *w* Western or Hardy (*speciosa*);

a Chinese (*ovata*).

42—HONEYSUCKLE FAMILY. Leaves opposite, ovary inferior.

Elder (*Sambucus*); *e* European (*nigra*).

Viburnum: Nanny-berry or Sheep-berry (*V. Lentago*); Black Haw
(*V. prunifolium*); *e* Wayfaring Tree (*V. Lantana*).

A. GUNDERSEN.

LEAFLETS

THE LIVING SOIL

It is really very much alive. A single teaspoonful of it may contain as many as 25,000,000 or more germs of various sorts (bacteria, molds, protozoa, etc.) A fertile soil especially, well provided with humus, is teeming with life; indeed, it must contain these living organisms in order to be fertile and to support plant life. "Mother Earth," of Greek mythology, is really a good name after all, for besides being very much alive, she is the bounteous provider of food, and thus the mother of mankind, as well as of all living things.

The soil, then, is not a lifeless lump of clay. When well tilled, it is full of pores like a sponge; and when in the best condition for plant growth, these pores contain an abundance of air as well as water. We may thus think of the soil as a honey-combed, spongy mass, made up of a hard framework composed of bits of mineral matter, the rock-particles, plastered over with a jelly-like substance (the decaying organic matter, or "humus"), containing countless billions of bacteria and other germs.

The great majority of these living organisms are present in the surface soil, where the humus is, and where the tilling of the soil has provided the porous, well-aerated condition necessary for the growth of the beneficial germs.

Further, their activity is greatest as a rule in late spring and in autumn, and lowest in summer and winter. For the winter cold checks them, as well as the summer dryness. The warming of the soil in spring, together with the spring rains, bringing an abundance of oxygen washed down out of the air, as well as the needful water, apparently cause the great outburst of germ activity in late spring. The autumn maximum may be attributed to the effect of the fall rains coming after the heat and drought of the summer.

There are both good and bad soil organisms. Some bring about the decay of plant and animal remains and the consequent liber-

ation of plant food; others do much harm, especially in causing "sick soils." The most of them are microscopic in size; others can be seen with the naked eye, such as the beneficent earthworm which burrows through and feeds on the soil humus, letting in air and drawing down leaves and other debris from the surface.

Beneficial soil organisms—These, fortunately for us, are readily controlled and their growth encouraged by certain proper agricultural practices. These beneficial organisms, in the first place, need a well-aerated, light, loamy soil for their best development. In a heavy, sticky, clay soil, devoid of humus, or a water-logged, sour, mucky soil, they will not grow. But in the soil made sweet by the addition of lime, well-stirred and oxygenated by cultivation, with a plentiful supply of decaying vegetable matter (humus), and, finally, with a sufficient amount of mineral nutrients in soluble form, the beneficial soil organisms flourish, and the harmful ones are killed off or at least kept in the back-ground.

The decay of plant and animal remains is brought about by beneficial bacteria and soil fungi; by this means, finally crumbling into dust, they again become dissolved in the soil water and thus available for plant food. Plant and animal bodies are composed of at least ten elements united into complex organic compounds: *Carbon, Hydrogen, Oxygen, Nitrogen, Sulphur, Phosphorus, Potassium, Iron, Calcium, and Magnesium*. Those in heavy type are the ones which are most apt to need replenishing in soils, and these the farmer often supplies to impoverished soils in the form of "artificial fertilizers." Of course if he would add to his poor soils manures and plow in legumes, the final decomposition of these organic materials would supply all the necessary elements. Manures, however, are often poor fertilizers, from having been carelessly preserved and allowed to leach away and otherwise lose ammonia and other valuable materials. These losses may be reduced by compacting the manure and storing under shelter.

Ammonification is the production of ammonia by bacteria and molds from manures and other decomposing organic bodies. This is accomplished by breaking-down processes comparable to digestions, performed by the enzymes secreted by certain bacteria and soil fungi.

Nitrification is the breaking down of this ammonia, accomplished by two very important sets of soil bacteria—the *nitrite* and the *nitrate* bacteria. One group converts ammonia into nitrites; another changes the nitrites into *nitrates*, the only form of nitrogen which green plants can use directly.

Fixation of nitrogen from the air by bacteria. The air is made up largely, nearly 80 percent, of nitrogen. If green plants could use this nitrogen directly we would not need to use sodium nitrate from Chile nor to employ other expensive means of nitrogen fertilization.

There are, however, two general groups of soil bacteria that have the power of taking the free nitrogen out of the air and "fixing" it, by changing it to nitrates and possibly other nitrogen compounds.

One group constitutes the "*legume bacteria*" (*Pseudomonas radiculicola*) of which there are said to be six varieties (the alfalfa—sweet clover, the clover, the vetch—garden pea, the cow-pea, the soybean, and the garden bean bacteria), which grow on the roots of plants of the legume family, in tiny swellings called "root-tubercles," or "nodules." These will not grow well except in soils which are sweetened with lime and well aerated. Further, the application of gypsum (calcium sulphate) to soils seems to have a remarkable stimulating effect on these legume bacteria, causing an increase, sometimes, equal to 100 percent, and causing the number of root nodules to be greatly increased.

The second group of nitrogen-fixers live free in the soil, not associated with the roots of plants. These bacteria are often called *Azo-bacteria*, and the process of nitrogen-fixation *Azofication*. There are two kinds of these Azofiers: one which lives under conditions of poor aeration (the anaerobic species), and one which requires plenty of air (the aerobic species) and called *Azotobacter*.

Harmful soil organisms—The harmful organisms of the so-called "sick" soils in greenhouses are thought by Professor Russell, of the famous English Rothamsted Experiment Station, to be protozoa, such as the amoeba and other forms of minute animal life, which he says apparently destroy the useful bacteria.

Also may be classed as harmful, the so-called "*denitrifying*" bacteria, which flourish in water-logged soils from which the air is largely excluded, and which destroy the nitrates which plants require and thus allow the escape of valuable plant food in the form of ammonia and nitrogen gas.

Some of the soil-decay organisms are the main cause of the *acidity* of low-lying fields, of swamp and muck lands. In fact, cultivated soils in general tend to become more and more sour, due to the accumulation of the more inert humic and other organic acids and the more rapid removal by drainage of the lime and other bases. Or, the use of acid phosphate and similar fertilizers also is said to cause an increase in soil acidity. Lime (calcium carbonate—ground limestone; or calcium hydroxide—

slaked lime) is used for the purpose of sweetening such acid soils.

Certain molds and fungus and animal *root-parasites* which may attack and even destroy the roots of plants, should also be mentioned as harmful soil organisms.

E. W. OLIVE

NOTICES

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily (except Sundays), from 9 a. m. until 5 p. m. (Saturdays, 9-12). The Conservatories are open April 1-October 1, 10 a. m.-4:30 p. m. (Sundays, 2-4:30); October 1-April 1, 10 a. m.-4 p. m. (Sundays, 2-4).

The Garden may be reached by Flatbush Ave. trolley to Malbone St.; Franklin Ave., Lorimer St., and Tompkins Ave. trolleys to Washington Ave.; St. John's Place and Rogers Ave. trolleys to Sterling Place; Vanderbilt Ave., Sixteenth Ave., Union St., Greenpoint, and Smith St. trolleys to Prospect Park Plaza and Union St., and Brighton Beach elevated to Consumers' Park Station.

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

Subscription for LEAFLETS **fifty cents a series** (comprising about twelve to fourteen numbers); free to members of the Botanic Garden and to teachers.

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LEAFLETS

SOME BROOKLYN WEEDS

Weeds are plants of robust growth which spring up on cultivated ground, on roadsides or about waste places. They are usually of unattractive appearance; a few, such as the daisy, dandelion, bindweed and moneywort, have conspicuous flowers. Most of the weeds in the Eastern United States have come from Europe and Asia; some, such as ragweed, Galinsoga, amaranth, Jimson weed, velvetleaf, carpetweed and pokeweed, are American. In cities other flowering plants are often difficult to obtain, but weeds offer excellent opportunity for the study of many botanical subjects, such as the structure of flowers and fruits, seed distribution, family characters, and other topics.

The following list includes the principal weeds found in or near the Brooklyn Botanic Garden. These are all flowering plants and belong to thirty-eight families, thus:

DICOTYLEDONS, leaves netted-veined.

Petals usually absent (apetalous), families 1-5.

Petals separate (polypetalous), families 6-21.

Petals united (sympetalous), families 22-35.

MONOCOTYLEDONS, leaves parallel-veined, families 36-38.

APETALAE

1—BUCKWHEAT FAMILY, sheaths about swollen joints. Dock (*Rumex crispus* and *Patientia*) Eu., Field Sorrel (*R. Acetosella*) Eu.; Creeping Knotweed (*Polygonum aviculare*) Eu., Smartweed (*P. Persicaria*) Eu., Climbing Knotweed (*P. Convolvulus*) Eu.

2—GOOSEFOOT FAMILY, minute greenish flowers, ovary one-celled. Goosefoot (*Chenopodium album*) Eu., Wormseed (*C. ambrosioides*) Am.; Orach (*Atriplex patula* and *A. patula hastata*) Arn. and Eu.

3—AMARANTH FAMILY, dry persistent bracts. Amaranth (*Amaranthus*) Am.

4—CARPETWEED FAMILY, fleshy plants, opposite or whorled leaves. Carpetweed (*Mollugo verticillata*) Am.

5—POKEWEED FAMILY, carpels united in ring, becoming a berry. Pokeweed (*Phytolacca decandra*) Am.

POLYPETALAE

6—PINK FAMILY, opposite leaves, swollen joints. Bouncing Bet (*Saponaria officinalis*) Eu.; Chickweed (*Stellaria media* and *graminea*) Eu.; Mouse-Ear Chickweed (*Cerastium vulgatum*) Eu.

7—PURSLANE FAMILY, fleshy plants, sepals fewer than petals. Purslane (*Portulacca oleracea*) Eu.

8—BUTTERCUP FAMILY, stamens numerous, all parts separate. Tall Buttercup (*Ranunculus acris*) Eu., Creeping Buttercup (*R. repens*) Eu.

9—MUSTARD FAMILY, 4 sepals, 4 petals, 4 long and 2 short stamens. Western Cress (*Radicula sinuata*) Am.; Peppergrass (*Lepidium virginicum*) Eu.; Shepherd's Purse (*Capsella Bursa-pastoris*) Eu.; Black Mustard (*Brassica nigra*) Eu.; Hedge Mustard (*Sisymbrium officinale*) Eu.

10—POPPY FAMILY, milky or colored juice, 2 sepals, fugacious. Celandine (*Chelidonium majus*) Eu.

11—MIGNONETTE FAMILY, parts unsymmetrical, stamens on one-sided disk. Wild Mignonette (*Reseda lutea*) Eu.

12—ROSE FAMILY, numerous stamens on calyx, leaves with stipules. Cinquefoil (*Potentilla canadensis*) Eu. and Am.

13—PEA FAMILY, corolla papilionaceous, leaves usually compound. Red Clover (*Trifolium pratense*) Eu.; Alsike Clover (*T. hybridum*) Eu.; White Clover (*T. repens*) Eu.; Yellow Clover (*T. agrarium*) Eu.; Sweet Clover (*Melilotus alba*) Eu.; Yellow Sweet Clover (*M. officinalis*) Eu.; Alfalfa (*Medicago sativa*) Eu.; Tick Trefoil (*Desmodium canadense*) Am.

14—GERANIUM FAMILY, 5-parted flowers. Small-flowered Cranesbill (*Geranium pusillum*) Eu.

15—WOOD SORREL FAMILY, 5-parted flowers, 3 leaflets. Wood Sorrel (*Oxalis stricta*) Eu.

16—SPURGE FAMILY, milky juice, usually apetalous, ovary 3-celled. Cypress Spurge (*Euphorbia Cyparissias*) Am.; Spotted Spurge (*E. maculata*) Am.; Three-seeded Mercury (*Acalypha virginica*) Am.

17—SUMACH FAMILY, shrubs, ovary 1-celled, 1 ovule. Poison Ivy (*Rhus Toxicodendron*) Am.

18—MALLOW FAMILY, stamens numerous, monadelphous. Velvetleaf (*Abutilon Theophrasti*) Asia; Mallow (*Malva sylvestris*) Eu.

19—ST. JOHN'S WORT FAMILY, leaves opposite, entire, dotted. St. John's Wort (*Hypericum perforatum*) Eu.

20—EVENING PRIMROSE FAMILY, flowers 4-parted, ovary inferior. Evening Primrose (*Oenothera biennis*) Am.

21—PARSLEY FAMILY, flowers small, in umbels; ovary 2-celled, 2-ovuled, inferior. Wild Carrot (*Daucus Carota*) Eu.; Wild Parsnip (*Pastinaca sativa*) Eu.

SYMPETALAE

22—PRIMROSE FAMILY, stamens opposite corolla lobes, ovary 1-celled. Moneywort (*Lysimachia Nummularia*) Eu.

23—MILKWEED FAMILY, milky juice, pollen cohering in masses, (pollinia). Milkweed (*Asclepias Syriaca*) Am.

24—MORNING GLORY FAMILY, twining herbs. Hedge Bindweed (*Convolvulus sepium*) Eu.; Small Bindweed (*C. arvensis*) Eu.

25—DODDER FAMILY, leafless climbing herbs, parasitic. Dodder (*Cuscuta Gronovii*) Am.

26—BORAGE FAMILY, hairy herbs, leaves alternate. Blue-weed or Viper's Bugloss (*Echium vulgare*) Eu.

27—VERBENA FAMILY, leaves opposite, corolla irregular. Verbena (*Verbena urticaefolia*) Am.

28—MINT FAMILY, stem square, leaves opposite, aromatic. Catnip (*Nepeta Cataria*) Eu.; Ground Ivy (*N. hederacea*) Eu.; Self-heal (*Prunella vulgaris*) Am. and Eu.; Motherwort (*Leonurus Cardiacus*) Eu.

29—POTATO FAMILY, leaves rank-scented, fruit a 2-celled capsule or berry. Jimson Weed (*Datura Stramonium*) Asia; Purple Jimson Weed (*D. Tatula*) Am.; Climbing Nightshade (*Solanum Dulcamara*) Am.; Matrimony Vine (*Lycium halimifolium*) Am.

30—FIGWORT FAMILY, fruit a 2-celled capsule with numerous seeds. Mullein (*Verbascum Thapsus*) Eu., Moth Mullein (*V. Blattaria*) Eu.; Butter and Eggs (*Linaria vulgaris*) Eu.

31—PLANTAIN FAMILY, stemless herbs, 4-parted spiked flowers. Common Plantain (*Plantago major*) Eu.; Rugel's Plantain (*P. Rugelii*) Am.; Hoary Plantain (*P. media*) Eu.; Narrow-leaved Plantain (*P. lanceolata*) Eu.

32—MADDER FAMILY, leaves in whorls, or opposite with stipules. Bed Straw (*Galium Aparine* and other species) Eu.

33—TEASEL FAMILY, flowers in head, stamens distinct. Teasel (*Dipsacus sylvestris*) Eu.

34—COMPOSITE FAMILY, flowers in close heads, anthers usually united. Fireweed (*Erechtites hieracifolia*) Am.; Cocklebur (*Xanthium commune*) Am.; Jerusalem Artichoke (*Helianthus tuberosus*) Am.; Great Ragweed (*Ambrosia trifida*) Am., Common Ragweed (*A. artemisiifolia*) Am.; Yellow-weed (*Galinsoga parviflora*) Am.; Beggar's Ticks (*Bidens*) Am.; Heath Aster (*Aster ericoides*) Am.; Goldenrod (*Solidago* sps.) Am.; Daisy Fleabane (*Erigeron ramosus*) Am., Horseweed (*E. canadensis*) Am.; Yarrow (*Achillea millefolium*) Am.; Tansy (*Tanacetum vulgare*) Eu.; Mayweed (*Anthemis Cotula*) Eu.; Daisy (*Chrysanthemum Leucanthemum*) Eu.; Canada Thistle (*Cirsium arvense*) Eu.; Burdock (*Arctium minus*) Eu.

35—CHICORY FAMILY, milky juice, flowers strap-shaped. Dandelion (*Taraxacum officinale*) Eu.; Red-seeded Dandelion (*T. erythrospermum*) Eu.; Sow Thistle (*Sonchus arvensis*) Eu.; Wild Lettuce (*Lactuca scariola*) Eu. and Am.; Chicory (*Cichorium Intybus*) Eu.; Goat's Beard (*Tragopogon pratensis*) Eu.

MONOCOTYLEDONS

36—SPIDERWORT FAMILY, jointed stems, leaves sheathed at base. Day Flower (*Commelina communis*) Asia.

37—RUSH FAMILY, grass-like herbs, 3 sepals, 3 similar petals. Rush (*Juncus tenuis*) Eu.

38—GRASS FAMILY, stem hollow; 2-ranked leaves, consisting of sheath and blade. Sandbur (*Cenchrus tribuloides*) Eu.; Crab Grass (*Digitaria sanguinalis*) Eu.; Barnyard Grass (*Echinochloa Crus-galli*) Eu.; Pigeon Grass (*Setaria glauca* and *viridis*) Eu.; Timothy (*Phleum pratense*) Eu.; Red Top (*Agrostis alba*) Eu.; Oats (*Avena sativa*) Eu.; Orchard Grass (*Dactylis glomerata*) Eu.; Panicum (several sp.); Snake Grass (*Eragrostis megastachya*) Eu.; Quack Grass (*Agropyron repens*) Eu.

A. GUNDERSSEN.

BROOKLYN BOTANIC GARDEN

LEAFLETS

SERIES VII

BROOKLYN, N. Y., NOVEMBER 12, 1919.

Nos. 10 and 11

THE GARDEN OF HARDY PLANTS*

There are good reasons for the revival of interest in the perennial garden, especially when compared with the claims of the formal bedding so much in evidence during recent years. One big objection to formal bedding is: the plants cannot be set out much before the first of June, and just at the time they are beginning to look their best they have to be hurried indoors for fear they will be nipped by the frost. Not so with the perennial garden. With proper management, something of beauty and interest may be had in bloom from March until November. There is nothing monotonous about it. The interest is continually changing with the seasons. In early spring snowdrops, crocuses, and the glory-of-the-snow spring up to remind us that winter is over. These are followed in turn by the irises, fitly termed the poor man's orchid; bleeding heart; peonies, ineffaceably associated with Memorial Day; and then, in the plethoric midsummer days, the phlox, golden glow, stately hollyhocks, yucca, fox-gloves, the plantain lilies, blanket flowers, the gorgeous marsh mallows, and the dainty blue bells. As the days begin to draw in, the great composite family has its inning. The many garden forms of our wild asters remind us that fall is coming. These receive greater appreciation abroad than here at home—more support for the adage that "a prophet is not without honor save in his own country." The perennial sunflowers are conspicuous in the fall with their bright yellow colors, and toward the close of the year the hardy chrysanthemums persist in their splendor well into November—glorious at a time when their only rivals are the autumn tints of the forest trees.

One great advantage of a garden of hardy plants that should appeal especially to those who like a flowerful garden but who

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cannot spend a great deal every year on its upkeep, is its economy compared with many other forms of gardening. Once the plants are in place they are there to stay, and, instead of having to be renewed every year, one is enabled to be generous at small cost in supplying friends with the increase.

Many of the hardy plants are admirable as cut flowers and provide a welcome change from the usual run of stock obtainable in the florists' stores. Just to remind you of the wealth of flowers, suitable for cutting plants, among the denizens of the old-fashioned flower border, the following are mentioned: peonies; iris, dahlia, gladiolus, delphinium, columbine, lily-of-the-valley, sea holly, baby's breath, blanket-flower, hardy sunflower, coral bells (*Heuchera*), pincushion flower (*Scabiosa*), and sea lavender. These are only a few of the many plants available for this purpose.

Although many of the plants will thrive even if they are neglected and no endeavor made to provide them with congenial soil and surroundings, one can scarcely expect to get the best results without giving some thought to their requirements. It is possible to obtain among the hardy plants some that will succeed under almost any kind of environment. Some like shade and languish in full sunshine; some are only happy when their "feet" are in water, or something approximating it; and some are most intolerant of anything like stagnant moisture at their roots. Many plants succeed best in clay soil, and some are only thoroughly at home when the soil is loose and sandy. These points should be taken into consideration when assigning plants their quarters in the garden. The result will be fewer unhappy plants and more satisfied gardeners. Most of the nursery firms that specialize in hardy plants publish catalogs in which the likes and dislikes of the plants are indicated. These catalogs are worth studying, although one must admit that some of these catalog writers are inclined to be optimistic with reference to the behavior of plants under adverse circumstances.

When a bed or border is made for the reception of hardy plants, it should be prepared on the assumption that the plants are to remain there for a number of years without removal. Some, it is true, of the stronger growing kinds need to be dug up and replanted every two or three years, but most of them succeed better if their roots are not continually being disturbed. Every effort should be made to have the soil in the best possible condition before the border is planted. The top soil should be broken up to a depth of a foot or eighteen inches, if it extends that far, and a liberal supply of well decayed manure buried as deeply as possible. This will encourage the roots to penetrate

deeply where they will be out of harm's way during periods of drought. If the preparation of the soil can be done in the fall, so much the better, as the ground will settle and be in fine condition for planting in the spring. Spring planting is usually to be preferred to fall planting, as it sometimes happens that the plants are thrown out of the ground by frost and greatly injured when planted late. They have no time to make new roots to anchor themselves in the earth before frost comes. This "heaving," as it is called, sometimes happens to well established plants during a severe winter, and is one reason for applying a mulch of strawy manure to the surface of the border in the fall. It is also a matter of routine work in the perennial garden to go around in the spring and replace those plants whose roots have been partly exposed by frost upheavals.

The size of the border is largely determined by the size of the area available for gardening. In large gardens the perennial border may be from fifteen to twenty feet wide and a hundred or more yards long. In such a garden the border does not necessarily assume a straight line, but may with advantage follow the contours of a belt of shrubbery. In a very small area the perennial garden may be nothing but a narrow strip along the boundary line, but nevertheless most interesting and enjoyable. One of the most delightful gardens the writer has ever seen was made on the site of an old orchard and was about an acre in extent. Many of the trees were left in place, and, although as fruit bearers they were negligible, they were most emphatically a success along aesthetic lines. Their gnarled and picturesque appearance was charming at all times, but in the spring, when covered with blossoms, their beauty was entrancing. This area was bounded by a low box hedge, and supplied with walks of irregular shaped flagstones informally meandering in every direction. The shade cast by the old trees enabled woodland plants to be grown to perfection, and in the open spaces sun lovers brightened the garden from spring to frost.

As a general rule (of course there are exceptions), the best effects cannot be obtained in a border less than six feet wide. A wide border gives endless opportunity for providing that element of variety and surprise so desirable in a garden. By bringing, at intervals, some of the taller growing plants toward the front of the border, little bays may be formed which serve to shelter and partly hide smaller plants. Thus the whole beauty of the garden is not revealed at once; as one walks along fresh subjects are constantly coming into view to charm the eye with their beauty, and, perchance, the nose, with their fragrance.

Endless combinations are possible with plants of the hardy

garden. It is possible to have a garden peopled entirely with plants having flowers of blue, or white, or yellow, or any other color found in the plant world. It is possible to indulge in carefully wrought-out color schemes, or to ignore these artistic considerations altogether and simply have a riot of color kaleidoscopic in effect. The garden may be planted so as to be at its best in spring, summer, or fall, or an all-the-year garden may be planted. Those who are regularly away from their garden during a part of the year will, of course, limit the plants to those kinds that bloom during the time that they are in residence. Another of the advantages connected with cultivation of hardy plants is the fact that, given fairly favorable conditions, they may be left unattended during part of the year without much injury.

A background is desirable in most cases. This may consist of tall growing shrubs or a creeper-clad wall. A border should never be planted, however, in such a situation that the flowers are robbed of moisture and food by the rapacious roots of trees. In the small garden there is often very little choice as to background, the party fence frequently being the limiting factor. In such cases the aim should be to make the best of a bad job and endeavor to clothe the fence with suitable climbers which will hide its usual ugliness.

Plants of a kind should be massed together in irregular drifts as much as possible. This applies especially to small growing plants whose beauty is often lost if dotted singly throughout the garden. The grading of the plants as to height should not be too rigorous. A more artistic effect is obtained if some of the taller plants are brought toward the front of the border. This will provide variety in the skyline of the border and obviate the effect of a regular, monotonous slope from back to front.

The distance allowed between the plants in the border is dependent upon their habit of growth. Three or four feet is not too much for some of the stronger growing subjects, such as dahlias, while the smaller plants can often be spaced as closely together as six inches. The whole of the area devoted to the border should be filled with plants. In connection with this point a distinguished horticulturist once said that "the garden might just as well be occupied with flowers as with weeds—when the border is well filled with desirable plants there is much less chance for the weeds to flourish."

Work in the perennial garden after it is once established consists of: keeping down weeds, maintaining a surface mulch to conserve moisture, thinning over-abundant growth, providing suitable support to such plants as need it, fighting insect and

fungous pests, annual fertilizing (not absolutely necessary, but usually desirable), and the replanting of some of the more rampant growers every two or three years.

Frequent use of the hoe is the best method of keeping down weeds. Some will grow in among the clumps of plants, and these must be removed by hand.

An efficient method of preventing much of the loss of moisture from the soil by evaporation is to stir the surface with a hoe or rake after every rain. This should not be done when the soil is so wet as to be sticky. A layer of partly decayed manure, two or three inches thick, over the surface of the border is beneficial, as it not only prevents loss of moisture, but provides a source of nutriment for the plant roots. When manure is unavailable, or if there are objections on the score of appearances, partly decayed leaves or even grass clippings may be used as a mulch.

Most gardeners, both amateur and professional, realize the necessity of thinning out the young seedlings in the vegetable row when they come up too thickly. Not so many are aware of the advantages to be gained by thinning the crowded growths of some of the hardy perennials. Such plants as phlox and delphinium produce larger and better spikes, or trusses of bloom, if the young growths are thinned when they are about two inches in length. This gives the remaining shoots an opportunity to attain their full development. These plants and many others of a similar nature produce so many shoots if left to themselves that there is a struggle for existence between the stems of individual plants. This is not so very serious if food and moisture are abundant, but if the opposite is true, it results in weak and spindling shoots and an inferior display of bloom. In a group of garden phlox, supposing them to be planted a foot apart each way, three shoots from each plant should be made to fill the allotted space.

Much could be written with reference to the proper way of giving support to plants that need assistance to maintain themselves in a state of uprightness and integrity. In some gardens that are fully exposed to strong winds, the taller plants are almost sure to be toppled over unless they are helped in some way. Far too often the remedy applied, instead of improving matters, does exactly the opposite. A group of shoots constricted in the middle by a string passed around them and fastened to a broomstick stuck at one side, does not present a picture that will satisfy any one having even the rudiments of artistic taste. Better far to let the plants blow over—they will at least look natural. The point to remember when staking and tying plants is that they must always be supported in such a way

that the supports are as inconspicuous as possible, and in such a manner that the beholder scarcely realizes that they are dependent on artificial means for their upstanding condition. Much can be done in this direction by placing iron hoops, supported on three or four legs, over the plants before they are fully grown. The subsequent growth of the plants almost entirely covers their supports. This method is very successful with plants that grow in clumps, such as peonies and delphinium.

It is a good plan to mulch the garden with manure in the fall as soon as the plants have died down. This will protect the plants during the winter and help to maintain the fertility of the soil. In the spring the coarse litter can be raked from the border and the remainder of the manure lightly forked into the surface soil.

Replanting of strong growing plants should be done when they begin to encroach upon the space reserved for less vigorous subjects. Some kinds will need replanting because of their poor growth, due to the exhaustion of available food materials in the soil. This need is indicated when the shoots in the center of the plant are weak and spindling with yellow basal leaves. When such plants are reset, advantage should be taken of the opportunity of incorporating manure in the soil beneath their roots.

MONTAGUE FREE.

NOTICES

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily (except Sundays), from 9 a. m. until 5 p. m. (Saturdays, 9-12). The Conservatories are open April 1-October 1, 10 a. m.-4:30 p. m. (Sundays, 2-4:30); October 1-April 1, 10 a. m.-4 p. m. (Sundays, 2-4).

The Garden may be reached by Flatbush Ave. trolley to Malbone St.; Franklin Ave., Lorimer St., and Tompkins Ave. trolleys to Washington Ave.; St. John's Place and Rogers Ave. trolleys to Sterling Place; Vanderbilt Ave., Sixteenth Ave., Union St., Greenpoint, and Smith St. trolleys to Prospect Park Plaza and Union St., and Brighton Beach elevated to Consumers' Park Station.

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

Subscription for LEAFLETS **fifty cents a series** (comprising about twelve to fourteen numbers); free to members of the Botanic Garden and to teachers.

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LEAFLETS

SERIES VII

BROOKLYN, N. Y., NOVEMBER 26, 1919.

Nos. 12 and 13

A BRIEF GUIDE TO THE CONSERVATORIES*

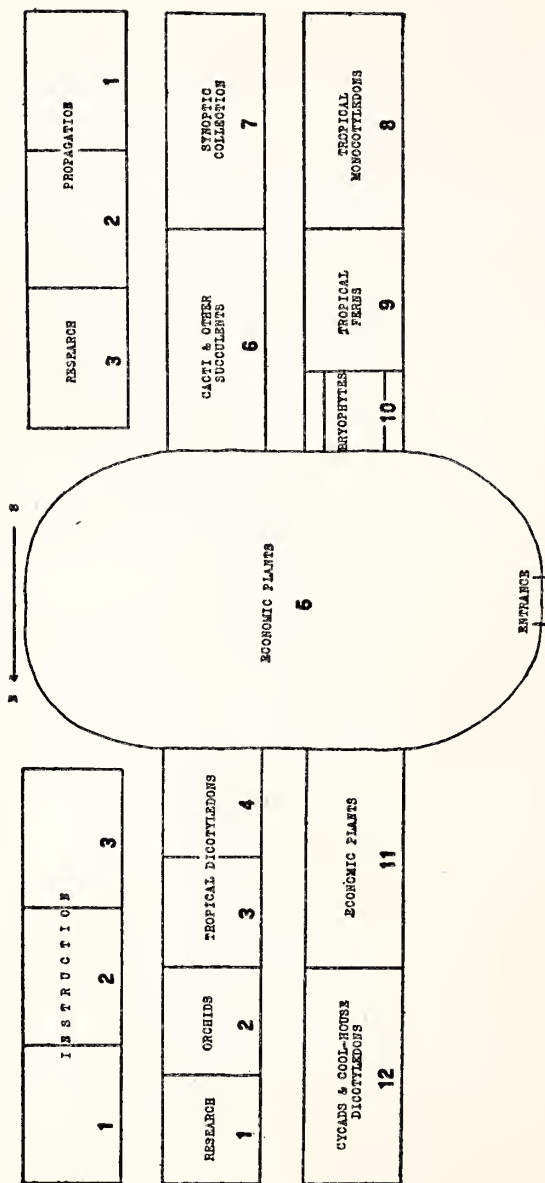
The public conservatory collections of the Garden now comprise over 500 genera and about 1500 species and varieties. These are contained in Plant Houses 2 to 12, shown on the accompanying plan: house number 1 and the propagation and instruction houses 1 to 3 are not open to the public. The public entrance from the grounds is through house 5, devoted to useful plants, such as drugs, foods, beverages, fibres, rubber, etc., and about which a special LEAFLET will be issued. Keeping to the right (which should be done throughout the walk), one comes first to the door of house 10, devoted to ferns from sub-tropical regions, or at least those not requiring the heat and humidity of house 9.

House 10—Upon the west bench are several varieties of the Boston Fern, the ancestor of scores of varieties of so-called "lace-ferns" and other variants of the well-known form. The Garden collection of these beautiful ferns is one of the best, if not the most complete in the country. On the opposite (east) side of the house are *Pteris* ferns, extensively used for table center-pieces and represented among others by *Pteris cretica* in variety, *Pteris serrulata cristata*, *Pteris ensiformis*, and many others. On the bench also is *Polystichum aristatum*. In the cases in the center of the house are mosses and liverworts.

House 9—Tropical ferns require much heat and moisture, which is apt to be the first impression one gets of this house. On the wall inside the door are many of the Stag-horn ferns, of the genus *Platycerium*, which have been much developed from their wild ancestor, and they are among the strangest and most uncommon objects of the plant world. Apparently living on nothing but water and air, they flourish with profusion. On the west side bench are many other variants of the Boston Fern, the most prolific "thrower of sports" in the fern kingdom. All degrees of fineness of foliage are to be found here, but the beauty of these delicate leaves is not for the average householder, as they will only thrive in the conditions found in the greenhouse. Just inside the door are some representatives of the nearly moss-like *Selaginella*, which often clambers over trees in its native haunts.

Hanging over the stairs is a peculiar fern, *Polypodium punctatum*, whose leaves, no matter from where they arise, invariably

*This LEAFLET is the last of Series VII. Series VIII will begin in April, 1920.



GROUND PLAN OF THE CONSERVATORIES OF THE BROOKLYN BOTANIC GARDEN

shoot straight upwards. The dense cluster of these upward-pointing, long, narrow leaves is a unique sight among ferns.

On the east bench of the house is a collection of those ferns most likely to be found in the flower shops, arranged to give the visitor an opportunity to study what seems to best meet his fern needs. Among these are the tropical Maiden-hairs and *Asplenium Nidus*, the well-named Bird's-nest Fern.

The raised bench in the center contains larger ferns, two of the finest being *Davallia Fijiensis* and *Davallia Fijiensis plumosa*, both unexcelled for the delicacy and fine texture of their foliage.

House 8—Tropical monocotyledons, plants related in stem structure to corn and bamboo and grass, are found in this house, among them being the palms. On the west bench only small plants of our *Sabal palmetto*, the only native American palm to reach the frost area (North Carolina), are grown. Close by is the beautiful *Cocos Weddelliana* from Brazil, much sold by the florists, and probably the most beautiful relative of the coconut palm. Further down on the west bench is the Spider-lily, *Hymanocallis expansa*, with huge but finely divided white flowers, which flourishes in tropical America. Near this is the Flax Lily, *Dianella coerulea*, from southeastern Australia, with beautiful blue flowers in mid-winter. Related to the ginger, of fragrant memory, is *Brachychilus Horsfieldii*, a stout herb from Java, and not far from the Flax Lily. Just beyond is *Schizocapsa plantaginea* from China, a representative of the family Taccaceae, an Old World group of plants of small numbers but curious flowers, which apparently replaces some of its flower-parts by delicate thread-like streamers. The last group on this west bench are tropical relatives of our Jack-in-the-Pulpit, among the most interesting of which is the Dumb Cane, *Dieffenbachia costata*, from Peru. The natives of that country make a decoction from the juice, the effects of which, while not permanent, are said to be terrifying to the talkative. Also from South America is the beautiful *Anthurium Andreanum*, whose odd scarlet flowers have made it a greenhouse favorite for years. Many of the plants of this Arum family climb over trees in the tropics; nearly all contain an acrid juice, and a few are poisonous, but not to the touch.

On the east side of the house are the bow-string hems, used as fiber by the natives in New Zealand and Africa; also the beautiful red-leaved *Cordyline terminalis*, belonging to the lily family. Related to it is *Dracaena Godseffiana*, from tropical Africa, whose spotted yellow-green-gold leaves have not inappropriately led to its name of Gold-Dust *Dracaena*. Nearer the door, and occupying at least two-thirds of the east bench, are members of the pineapple family, including the edible variety of our markets, all natives of tropical America and containing some of the most beautiful foliage plants known. Marbled, spotted, banded and all-over colors of green, yellow, purple, bronze and copper are to be found in the collection, nearly all of which naturally grew epiphytically upon trees and even telegraph wires in the tropical American regions. Some of them, particularly the purple-banded *Vriesia splendens* and *Guzmania musaica*, are the finest of foliage plants. Most of the plants of this family, Bromeliaceae, produce very showy spikes of highly colored flowers and bracts, so that they are most worth while in any greenhouse. Of this family, and hanging in the air, is a specimen of Florida Moss

which drapes the trees in our Southeastern States as the lichen does in the north woods. There are hundreds of species of Bromeliaceae known, of which we have only a modest representation.

In the center of the house is the Chinese ground rattan, *Rhapis humilis*, an almost hardy palm which will stand some frost and is grown outdoors in Surrey and Devon, and of course in California. A tall specimen of the fountain plant, *Cordyline australis*, from New Zealand, is also in the center of the house. It is a sturdy plant, the long, narrow, leathery leaves of which make it suitable for home culture. It will stand the conditions of the ordinary room better than most greenhouse plants. Near it are specimens of *Phoenix Roebelinii pendulosa*, a graceful drooping relative of the date palm, and also *Washingtonia filifera robusta*, from Southern California, the thread-like margins of whose leaves are characteristic and not an injury, as the casual might infer. Among the fan-leaf palms, our largest specimen is *Livistona chinensis*, common in all the flower shops.

Retracing our steps, still keeping to the right and not forgetting to close the doors which separate such variations of heat and moisture, we come back through the Economic House (5) to house 6, devoted to succulents.

House 6—Nearly all the plants in this house are inhabitants of deserts or desert-like regions. On the west bench, just inside the door, are *Dyckia* and *Hechtia*, drab little members of the Bromeliaceae, or pine-apple family, quite different from the gorgeous kinds in the tropical house (8). Beyond these are the Fig-marigolds, or Ice Plants, all belonging to the genus *Mesembryanthemum*, which is represented in South Africa by over 400 species, and in our collections by probably 10. Further down are specimens of the Candle Plant, *Kleinia anteuphorbia*, also of South Africa and most appropriately named. Its candle-like stems are topped with yellow flowers not unlike our native *Senecio*. At the end of this west bench are members of the Crassulaceae or House Leek family, which includes hundreds of succulents, mostly with thick, fleshy basal leaves, an exception to which is the Sprouting Leaf, *Bryophyllum pinnatum*. The leaves of this truly remarkable plant, no matter if cut to pieces, sprout into many little plants which take root and grow, so that the species is in small danger of extermination through injury.

The whole of the east bench is devoted to the cactus family, a group of succulents of great variety of shape and habit, almost exclusively American. Nearest to the south end is the Crab-Cactus, *Zygocactus truncatus*, bearing somewhat profusely its red tubular flowers. Near it is the Strawberry Pear, *Hylocereus tricostatus*, a three-angled cactus from Mexico, which bears great flowers at least four inches long. Not far away are several specimens of "Night-blooming Cereus," a name applied to at least half a dozen nocturnal flowering species. All are tropical American and climb over trees. Their great cream or white funnel-shaped flowers, often 6 to 8 inches long, are well worth waking up to see. They last only a night or two, some only a few hours. All of the plants north of this on the east bench are prickly pears, *Opuntia* or its relatives, of which a recent monograph describes 250 species. They are often flat-jointed cacti, producing handsome flowers and, in some cases, edible fruits. The latter, without proper attention, may choke the unwary, as some of the spines are found inside certain of the otherwise good fruits and must be removed.

On the north center bench are some of the Carrion-flowers, queer little foetid relatives of our Milkweeds, which grow in South Africa and produce strange star-fish shaped flowers of evil odor and sinister markings. These *Stapelias* are among the most curious of all the succulents. Higher up on the bench is the Crown-of-thorns, *Euphorbia splendens*, from Madagascar, horribly spiny, but producing beautiful red flowers from its tortuous branches.

On the south center bench are representatives of the Century Plants, *Agave*, a genus which has hundreds of forms in the American tropics and is the source of pulque and sisal, and of many highly ornamental plants.

House 7—This house, while open to the public, is not yet completely furnished. It is planned to show a representative of each of the plant families arranged to show their development and relationship. A special LEAFLET will be issued later.

Coming back through House 6 into Number 5, and keeping to the right, we pass the pool and come to the entrance of House 4.

House 4—Not far from the door, on the east bench, is a small vine with leaves like an oak, *Ficus quercifolia*, a fig from Malaya. Farther north are young specimens of *Malvaviscus arboreus*, from South America, a tree relative of our native Marshmallow. Near the door to the next house is the sensitive plant, *Mimosa pudica*, so called from its acute reaction to shock. Even the slightest jar to the smallest leaflet will result in its collapse, and if the stem is touched, the whole plant "goes to sleep." It will recover in ten or fifteen minutes. No plant, so far known, is so sensitive to touch as this. Near it is the Telegraph plant, *Desmodium gyrans*, remarkable for the movement of its leaflets. In warm, moist air they move up and down, either regularly or in jerks, not of course rapidly. On the same bench is a beautiful milkweed from the Gulf States and tropical America, *Asclepias curassavica*.

On the west bench are plants of the variegated *Fittonia argyrea variegata* from Peru, and a form of the Rose Mallow, *Hibiscus rosa-sinensis Cooperi*. The dark red petals of these contain a juice used for blacking boots in Haiti and Santo Domingo. Near it is a small plant of one of the most beautiful trees of the Philippines, *Medinella magnifica*. It belongs to the same family as our native Meadow Beauty and bears tremendous clusters of scarlet showy flowers in late winter. Also on this bench is *Erythroxylon Coca*, a shrub from the Andes, which is the source of Cocaine and from which a popular beverage is named.

In the center of the house is a plant of *Tecoma stans*, a native tree of tropical America, which bears beautiful yellow flowers not unlike our trumpet creeper, to which it is related.

On the western edge of the center bench is a plant of Mountain Bear's Breech, *Acauthus montanus*, from tropical Africa. Its handsome spiny leaves are striking subjects for decorative effects. Another very showy plant is the Glory Tree (on the floor) *Clerodendron Thompsonae*, also from Central Africa, and related to Verbena. Its scarlet and white flower clusters are borne in profusion. Near it is a tub of the Fiddle-leaved Fig, *Ficus lyrata*, which bears large handsome leaves, often seen in the florists, and inedible fruits.

House 3—Climbing over the roof from a pot on the east bench, is a plant of *Allamanda Hendersonii* from Guiana, a relative of our Dogbane, with splendid yellow tubular flowers. Close by is the Cone Head, *Strobilanthus Dyerianus*, from Burma, so called

from its compact cone-like head of flowers enclosed in colored bracts. Nearly all the rest of the bench is taken up by a collection of Begonias, of which *Begonia Rex* is the best known. These are all natives of tropical forests, some grown for the beautiful markings of their foliage and others for the curious flowers which are usually pink or white and borne in weak clusters.

On the west bench is a miscellaneous collection of tropical plants from all over the world, among them several kinds of *Acalypha*. Of these, the Chenille Plant, *A. hispida*, with red finger-like clusters of flowers, is the most striking. At one end of the bench are several varieties of *Croton*, handsome foliage plants, much used for decorative planting in the tropics, and all belonging to the same genus, *Codiaeum*, of the Spurge family.

A tub on the floor contains the most interesting aquatic in our collections, the Lace-leaf, *Aponogeton fenestratis*. The leaves are permanently and naturally skeletonized, the delicate tracery of the midrib and finer veins appearing as if some agency had etched out the body of the leaf, leaving only the fine framework. It grows in shady pools and streams in Madagascar.

House 2 is devoted to orchids, of which more than 6000 species are known. The garden collection of perhaps 50 species, is rich in *Paphiopedilum*, which is on the east bench and simulates our native Lady's-Slipper. *Dendrobium nobile* and *Dendrobium aureum*, both fine Asiatic orchids, with beautiful long flower clusters (midwinter), are near this, also the lavender flowered *D. primulinum* with a touch of white.

On the west bench near the north end of the house, and also on the center bench, are many specimens of *Cattleya*, which are the only orchids familiar to those people who buy them at the florists. They are legion in the color and form of the flowers, though unusually large, and among the best of them are *Cattleya Trianae*, *C. Schroederiae*, *C. Mendelii*, and *C. labiata*, the latter being the best known. All are in the collections, and flower mostly in the winter. Near them on the west bench is *Angraecum sesquipedale*, from Madagascar, whose somewhat unprepossessing name conceals an interesting prophecy by Darwin. When first shown the flower with its extraordinarily long tube, sometimes 18 inches long, he said that a moth with a tongue long enough to reach the nectar would some day be discovered in Madagascar. Years afterward it was found by Humboldt.

In the slate tank at the end of the house are some plants of the Water Hyacinth from Brazil, a floating aquatic of great beauty but so rampant that it literally fouls the paddle-wheels of steamers in the St. John's River, Florida, where it was introduced. Hanging over the tank are a few of the Pitcher plants, *Nepenthes*, inhabitants of the steaming tropical forests of the old world, and famous as insect catchers. A digestive juice is secreted at the base of the pitcher, which is arranged so that an insect can go in but not out.

The door leading to the next house is kept closed and this house, No. 1, which is used for research work, is not open to the public. Retracing our steps, then, through the orchid house and through houses 3 and 4, we come again to house 5. Still keeping to the right we reach the door to House 11.

House 11—Just inside the door on the east bench is Mother-of-Thousands, *Saxifraga sarmentosa*, from China and Japan, which, if broken up at the joints, will produce a plant for each piece. Beyond is a small plant of *Casuarina torulosa*, which is a tree on tropical sea shores. An Australian silk-oak, *Grevillea robusta*,

one of the handsomest trees of that country, is just beyond. The "Sacred Bamboo," *Nandina domestica*, which is not really a bamboo and grows in China and Japan, is related to our common barberry. Near it is Butcher's Broom, *Ruscus aculeatus*, from Europe whose leaf-like stems are often colored for Christmas decorations. The East Indian Anise, *Illicium Anisetum*, related to *Magnolia*, is the plant for many years confused with the star anise of Japan.

On the same east bench is a queer leafless relative of our knot-weed, *Polygonum equisetiforme*, from the Mediterranean region. It is all stem and tiny flowers and forms inextricable thickets in its native country.

The west bench of the house, has on it the little blue daisy of South Africa, *Felicia amelloides*, a small aster-like shrub with solitary flowers at the ends of the twigs. Near it is the tea plant, *Camellia Thea*, of Tropical Asia, and the Peruvian Heath, *Fabiana imbricata*, which is related to the potato and sails under false colors so far as being a heath is concerned. It looks, however, a good deal like a true South African Heath. Near the door is the parlor ivy, *Senecio scandens*, from China, a thrifty vine that can be grown fairly well in ordinary house conditions. It has small yellow flowers not unlike the native Senecios.

In the center of the house is the Kumquat, *Fortunella japonica*, the Orange, *Citrus sinensis*, the Olive, *Olea europaea*, and the Loquat, *Eriobotrya japonica*, all bearing edible fruits and all of sufficient size to bear them here. Among them are the tall sword-shaped leaves of New Zealand Flax, *Phormium tenax*, which is to that country what sisal is to Yucatan. The date palm, *Phoenix dactylifera*, not yet of bearing age, and the true laurel of the ancients, *Laurus nobilis*, are also in the center.

House 12—Keeping to the right, one of the first plants on the east bench is a small specimen of *Bougainvillea glabra*, from Brazil, probably the most magnificent vine in the world. Its great flaming flower clusters are carried up to the tops of the tallest houses and trees in the tropics. Another tropical vine, sometimes called the Mountain Rose, is *Antigonon leptopus*. It climbs to moderate heights and is related to the Buckwheat. Near it is the Indian Plum, *Flacourtia sepiaria*, belonging to a family of plants common in the tropics (Flacourtiaceae), but with no close relatives in our own flora. On the west bench are plants of the Bottle Brush, a species of *Melaleuca*, from Australia. Its large dense clusters perfectly suggest colored bottle brushes. There many other species of this genus in Australia all belonging to the Myrtle family, and many of them bearing very showy flowers. About the middle of the bench is the St. John's Bread, *Ceratonia siliqua*, from the Mediterranean Region. It is related to our locust tree and bears long edible pods often sold in the shops on the East Side, and a common source of food in the plant's native country. It is reputed to be the "locusts" which played a part in the diet of John the Baptist. The Oleander, *Nerium Oleander*, is found near the south end of the bench. It is a beautiful shrub of tropical and sub-tropical regions, with often vari-colored flowers.

By far the most interesting plants from a botanical view-point to be found in our collection, are in the large tubs in the center of the house. They are Cycads, mostly from Australia, and belong to an ancient but vanishing race of plants. They have no common names known to us, but attention should be drawn to *Macrozamia Moorei* and *Macrozamia spiralis*, both secured by the Garden from the interior of New South Wales at very considerable trouble and

expense. In their native haunts they have to contend not only with the fact that they are part of a gradually diminishing race of plants once dominant in the world, but *Macrozamia Moorei* is on the point of extermination because its young leaves are poisonous to cattle. Our plants of this, only duplicated at one or two other places in the country, are therefore the most valuable in our collections. Related to *Macrozamia* are *Cycas media*, also imported from Australia in 1916, and *Cycas revoluta*, or the so-called Sago Palm, much used for funeral decorations, and common in all greenhouses. All these Cycads are interesting as bearing their seeds quite nakedly and not enclosed in various coverings such as the fruits so common in the rest of the plant world. In many of them the sexes are on different plants indicated by "carpellate" (female) and "staminate" (male) plants which are so labelled. Of the rare Australian species we have at least one of each sex.

On the floor near the (locked) door at the north end, is a plant of the Blue Gum, *Eucalyptus globulus*, also from Australia. Mature plants of this may well be the tallest trees in the world. They certainly equal in height, but not in girth, our own Big Trees, and the genus *Eucalyptus*, of which hundreds of species are known, is one of the most important in the world from a timber standpoint.

NORMAN TAYLOR.

NOTICES

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily (except Sundays), from 9 a. m. until 5 p. m. (Saturdays, 9-12). The Conservatories are open April 1-October 1, 10 a. m.-4:30 p. m. (Sundays, 2-4:30); October 1-April 1, 10 a. m.-4 p. m. (Sundays, 2-4).

The Garden may be reached by Flatbush Ave. trolley to Malbone St.; Franklin Ave., Lorimer St., and Tompkins Ave. trolleys to Washington Ave.; St. John's Place and Rogers Ave. trolleys to Sterling Place; Vanderbilt Ave., Sixteenth Ave., Union St., Greenpoint, and Smith St. trolleys to Prospect Park Plaza and Union St., and Brighton Beach elevated to Consumers' Park Station.

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

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